Appendix A

Local-Scale Emissions Inventory
Focus Group Meeting Summaries

Focus Group Meeting 1

Date: May 19, 2010
Time: 3:30 PM EDT

Core participants present:

- Lee Tooly, EPA
- Steve Reid, Sonoma Technology
- Leigh Bacon and Tim Martin, Alabama DEM
- Jim Boylan and Byeong Kim, Georgia DNR
- Jeff Sprague and Buzz Asselmeier, Illinois EPA
- Jeff Bennett, Missouri DNR
- Brian Bohlman and Ken Rairigh, Wyoming DEQ

Peer reviewers and other participants present:

- Jeff Stoakes, Indiana DEM
- Bob Downing, Maricopa County (AZ)
- Kate Edwards, Pinal County (AZ)
- Steven Brown, EPA Region 7
- Mark Komp, EPA Region 8

Agenda

1. Introductions
   - What group do you work with?
   - How does the group relate to the emissions inventory (EI) development done by your agency?
   - What role have you played in characterizing emissions for fine-scale air quality modeling?
2. Discuss project and desired outcomes
3. Review project roles
4. Discuss next steps

Meeting Summary

1. Introductions
   - Introductions for this kick-off meeting confirmed that focus group representatives from each agency include both emissions developers and air quality modelers.
   - Modeling experience includes SIP and permit/NSR modeling (i.e., use of AERMOD and CMAQ models).
   - The types of emissions inventory experiences include annual average estimates, SIP-specific, and potential to emit for permits.
   - Discussion of organizational relationships required to conduct fine-scale modeling assessments emphasized the involvement of both emissions developers and

modelers in scoping and resolving issues. It was noted that, at times, air quality modelers get involved in more emissions work than they want or expect.
- Many of the local-scale EI efforts described have prioritized emissions characterization improvements for specific sources impacting violating monitors.

2. Discuss project and desired outcomes
   Lee Tooly reviewed the following:
   - Background – how this project was conceived (i.e., as a follow-up to EPA's Detroit multi-pollutant assessment).
   - SIP modeling guidance now includes recommendations for fine-scale multi-pollutant modeling.
   - The operating assumptions for the project are that state and local agencies and regional organizations are best positioned to improve inventories to make them more "local-scale" in nature, and that any inventories developed to improve local-scale modeling can also improve the National Emissions Inventory (NEI).
   - Project outlook – we will focus on the charge questions and desired outcomes provided in the project outline.
   - No comments or concerns were expressed by participants.
3. Review project roles
   - Core participants will focus on presenting answers to the charge questions, including data analysis and results that will help describe their experiences to the group.
   - Peer reviewers will attend as many meetings as they can, take part in discussions, and review the group's work and recommendations.
   - Contractor support, when in place, will provide assistance with group facilitation, summary and clarification of information exchanged, and documentation of project findings and recommendations.
   - Lee will facilitate meetings, provide overall management to the project, bring an NEI perspective, and share results from EPA's Detroit multi-pollutant study.
   - No comments or concerns were expressed about project roles.
4. Discuss next steps
   - Core participants will begin to organize their thoughts around the charge questions and consolidate data examples, including any suggested resources or web links that may be helpful to the group.
   - Core participants are encouraged to email answers to the charge questions to Lee.
   - Upon completion of answers to the charge questions, core participants will discuss highlights of their work with the group via a 30-minute presentation.
   - Meetings will be held bi-weekly and will initially consist of two 30-minute presentations by core participants.
   - Bi-weekly meetings thereafter will focus on discussions of lessons learned from the presentations and will work toward developing recommendations for conducting this type of work.

Focus Group Meeting 2

Date: June 15, 2010
Time: 2:30 PM EDT

Core participants present:

- Lee Tooly, EPA
- Steve Reid, Sonoma Technology (STI)
- Jayme Graham and Jason Maranche, Allegheny County (PA)
- Leigh Bacon and Lisa Cole, Alabama DEM
- Jim Boylan, Georgia DNR
- Jeff Sprague and Buzz Asselmeier, Illinois EPA
- Brian Bohlman, Wyoming DEQ

Peer reviewers and other participants present:

- Sherry Bogart, Pennsylvania DEP
- Bob Downing, Maricopa County (AZ)
- Kate Edwards, Pinal County (AZ)
- Matt Poppen, Maricopa Association of Governments (MAG)

Agenda

1. Review project status
2. Review the charge questions
3. Discuss preferences for organizing and disseminating information from each agency
4. Schedule future calls and presentations
5. Next steps

Meeting Summary

1. Review project status
   - The contractor is on board: Steve Reid of Sonoma Technology.
   - Group calls will take place on a bi-weekly schedule: Tuesdays at 2:30 PM EDT unless otherwise noted.
   - Illinois EPA has provided answers to charge questions.
2. Review the charge questions – Lee described them with brief context:
   - What type of air quality problems were addressed with fine-scale modeling?
   - What analysis techniques were used to evaluate emissions biases, identify key sources in your area, and prioritize inventory improvement work?
   - For which source categories were emissions estimates improved and what methods were used?
   - What changes to emissions estimates and modeling results occurred because of local-scale emissions inventory development efforts?
   - Would any NEI-related analyses be particularly helpful to your efforts? (If so, at what step in the process would such analyses be beneficial?)

3. Discuss preferences for organizing and disseminating information from each agency
   - Steve Reid at STI emphasized that we want to get basic answers to the charge questions from each agency and focus on disseminating that information to the group.
   - All parties present indicated that they have started addressing the charge questions or thinking about how to do that.
   - Several participants will likely start by providing Lee and Steve with a one-page summary of answers to the charge questions, as Illinois EPA has done.
   - The group agreed that we will focus on emissions inventory development and air quality modeling issues, with less focus on the regulatory requirements behind the modeling.
4. Schedule future calls and presentations
   - June 29: AL DEM and Cleveland DAQ
   - July 13: Allegheny Co. and Georgia DNR
   - July 27: Illinois EPA and Missouri DNR
   - August 10: Maricopa County and Wyoming DEQ
5. Discuss next steps
   - Lee will distribute summary notes from this meeting.
   - Lee will set up GoToMeeting sessions for future calls.
   - All core participants will address the charge questions and email answers to Steve at STI.
   - Steve will check in with David Hearne at Cleveland DAQ to confirm his scheduled presentation.
   - Lee will check in with Jeff Bennett at Missouri DNR to confirm his scheduled presentation.

Focus Group Meeting 3

Date: June 29, 2010
Time: 2:30 PM EDT

Core participants present:
- Lee Tooly, EPA
- Steve Reid, Sonoma Technology
- Jayme Graham and Jason Maranche, Allegheny County (PA)
- Leigh Bacon, Alabama DEM
- Buzz Asselmeier, Illinois EPA
- Brian Bohlman, Wyoming DEQ

Peer reviewers and other participants present:
- Sherry Bogart, Pennsylvania DEP
- Bob Downing, Maricopa County (AZ)
- Kate Edwards, Pinal County (AZ)
- Erin Pollard, Sonoma Technology

Agenda

1. Presentation and response to charge questions by Alabama DEM
2. Presentation and response to charge questions on the Cleveland Multiple Air Pollutant Study (CMAPS) by Sonoma Technology
3. Next steps

Meeting Summary

1. Presentation and response to charge questions by Alabama DEM
    - Birmingham area in non-attainment for 1-hour ozone and annual $PM_{2.5}$; new ozone standard may affect other areas of the state (e.g., Mobile and Huntsville).
    - Fence-line monitoring, trajectory analyses, QD analyses, and other techniques used to identify key sources of $PM_{2.5}$.
    - Emissions inventory improvements previously focused on the point source sector; currently, attention is being given to area, fire, and mobile inventories.
    - In their modeling, revised stack parameters significantly altered impacts from point sources.
2. Presentation and response to charge questions on CMAPS by Sonoma Technology
    - CMAPS is a year-long study by EPA and local agencies of sources of air pollution in Cleveland (which is in non-attainment of the annual and 24-hr $PM_{2.5}$ standards).
    - Monitoring data (pollution roses) and reviews of existing EI data were used to identify key sources of $PM_{2.5}$/precursors in the area.
    - Emissions inventory improvements primarily focused on the point source sector, including evaluations of 21 key facilities in Cleveland and numerous regional power plants.

- Some updates were also made to on-road and non-road mobile source inventories.
- EPA will conduct CMAQ modeling with the updated inventory, as well as receptor modeling with monitoring data being collected during the study.

3. Next steps
    - The July 13 meeting will feature presentations by Allegheny County and Georgia DNR
    - The July 27 meeting will feature presentations by Illinois EPA and Missouri DNR.
    - The August 10 meeting will feature presentations by Maricopa County and Wyoming DEQ.

Focus Group Meeting 4

Date: July 13, 2010
Time: 2:30 PM EDT

Core participants present:

- Lee Tooly, EPA
- Steve Reid, Sonoma Technology
- Jayme Graham and Jason Maranche, Allegheny County (PA)
- Leigh Bacon, Alabama DEM
- Jim Boylan, Georgia DNR
- Jeff Sprague, Illinois EPA
- Brian Bohlman, Wyoming DEQ

Peer reviewers and other participants present:

- Sherry Bogart, Pennsylvania DEP
- Kate Edwards, Pinal County (AZ)
- Alice Chow, EPA Region 3
- Steven Brown, EPA Region 7
- Mark Komp, EPA Region 8

Agenda

1. Presentation and response to charge questions by Allegheny County
2. Presentation and response to charge questions by Georgia DNR
3. Next steps

Meeting Summary

1. Presentation and response to charge questions by Allegheny County
    - Emissions inventory improvements and modeling focused on excess $PM_{2.5}$ in the Liberty-Clairton nonattainment area, a small region in southeastern Allegheny County.
    - Excess species analyses, trajectory analyses, and receptor modeling with PMF were used to characterize sources contributing to excess $PM_{2.5}$.
    - EI improvements focused on the largest coke plant in the county; in particular, performing stack testing on one of the facility's quench towers.
    - Emissions estimates changed significantly, with a 1700 ton increase in baseline emissions and a 450 ton reduction in a future controlled case (new coke batteries based on German Uhde design).
2. Presentation and response to charge questions by Georgia DNR
    - Focus of local-scale EI and modeling is demonstrating attainment with annual $PM_{2.5}$ NAAQS in Atlanta by 2012.
    - Fire Station #8 monitor shows consistently higher $PM_{2.5}$ concentrations than other area monitors.

- Receptor modeling (PMF), wind direction analysis, and emission threshold criteria were used to identify key sources impacting the Fire Station #8 monitor.
- EI improvements primarily focused on three large railyards near the Fire Station #8 monitor, though some attention was also given to on-road mobile sources and point sources.
- Local sources were modeled with AERMOD.
- 2012 design values were adjusted and based on local emissions reductions (e.g., replacing 25 switcher locomotives with cleaner Gensets.

3. Next steps
   - The July 27 meeting will feature presentations by Illinois EPA and Missouri DNR.
   - The August 10 meeting will feature presentations by Maricopa County and Wyoming DEQ.

Focus Group Meeting 5

Date: July 27, 2010
Time: 2:30 PM EDT

Core participants present:

- Lee Tooly, EPA
- Steve Reid, Sonoma Technology
- Jason Maranche, Allegheny County (PA)
- Leigh Bacon and Lisa Cole, Alabama DEM
- Jim Boylan and Byeong Kim, Georgia DNR
- Jeff Sprague, Illinois EPA
- Brian Bohlman, Wyoming DEQ

Peer reviewers and other participants present:

- Bob Downing, Maricopa County (AZ)
- Matt Poppen, Maricopa Association of Governments (MAG)
- Kate Edwards, Pinal County (AZ)
- Alice Chow, EPA Region 3

Agenda

1. Presentation and response to charge questions by Illinois EPA
2. Next steps

Meeting Summary

Jeff Sprague of Illinois EPA presented information on 3 topic areas:

1. Developing an SO_2 inventory for oil field flaring activity in Illinois
   - This work was driven by revisions to the primary NAAQS for SO_2 that will become effective on 8/23/2010.
   - A history of citizen nuisance complaints has led to a consent decree with a major operator for reducing hydrogen sulfide (H_2S) emissions. This is largely accomplished by flaring sour gas that is co-produced with oil and has a high sulfur content.
   - No comprehensive inventory exists of the potentially thousands of flares in the Illinois Basin, and these sources are not currently subject to permit requirements.
   - A proposed approach for inventory development involves working with IL DNR to obtain information on flare locations and types, coupled with site visits.
2. The St. Louis Air Quality Management Plan (AQMP): Technical Implementation Phase
   - Partners for this project are IL EPA, MO DNR, and EWGCOG (St. Louis planning organization).
   - The St. Louis AQMP is implementing a multi-pollutant approach that integrates air toxics, climate change, and other issues with NAAQS attainment.
   - The AQMP will use existing 2007/2008 emissions inventories and focus on the urban core of the metropolitan area for toxics inventory development.

- A 1-km resolution grid is envisioned for urban core toxics modeling (AERMOD to be used for local lead and SO_2 analyses).

3. Granite City, IL $PM_{2.5}$ Nonattainment: Regional and local scale modeling, data analysis, and emissions control developments
   - Annual CMAQ modeling shows that projected 2012 design values for all monitors in the St. Louis nonattainment area demonstrate attainment—except for the Granite City, IL monitor, which is in an industrialized area (Metro-East).
   - Since regional modeling (36- and 12-km resolution) did not adequately capture fine scale concentrations in the Metro-East area, a local area analysis was undertaken using AERMOD for local sources.
   - PMF factor analysis showed a large contribution from a U.S. Steel plant in Granite City. This was corroborated by AERMOD source contribution results, which showed that 87% of the 3.95 $\mu g/m^3$ contributed by all local sources was attributable to U.S. Steel.
   - AERMOD-derived relative response factors (RRFs) greater than 1.0 (attainment not demonstrated for the Granite City monitor).
   - 2012 design value for Granite City separated into regional and local components for calculation of future design values.
   - Inter-monitor comparisons used for source attribution to build a case that U.S. Steel was responsible for local excess emissions.
   - Differences between total $PM_{2.5}$ mass at the Granite City FRM and a downtown St. Louis site were combined with surface meteorological data to show excess $PM_{2.5}$ attributable to U.S. Steel.
   - Similarly, speciated PM comparisons were done between a Granite City site and a site in downtown St. Louis, and this analysis showed that the Granite City site was routinely getting higher values for iron (and to a lesser extent, OC and fine mass).
   - A memorandum of understanding has been entered into with the steel plant to set PM emission limits and install new control systems.

Next steps

- The August 10 meeting will feature presentations by Maricopa County and Wyoming DEQ.
- During the August 24 meeting, we will begin a discussion of overall themes, issues, and findings.

Focus Group Meeting 6

Date: August 10, 2010
Time: 2:30 PM EDT

Core participants present:

- Lee Tooly, EPA
- Steve Reid, Sonoma Technology
- Jayme Graham and Jason Maranche, Allegheny County (PA)
- Leigh Bacon, Alabama DEM
- Jim Boylan and Byeong Kim, Georgia DNR
- Brian Bohlman and Ken Rairigh, Wyoming DEQ

Peer reviewers and other participants present:

- Kate Edwards, Pinal County (AZ)
- Mark Komp, EPA Region 8

Agenda

1. Presentation and response to charge questions by Wyoming DEQ (staff from Maricopa County unable to participate further)
2. Overview of topics for the wrap-up discussion that begins on August 24

Meeting Summary

Brian Bohlman and Ken Rairigh of Wyoming DEQ, who presented information on ozone modeling and emissions inventory development for oil and gas production sources in their state. Key concepts presented include:

1. The impetus for the emissions inventory development and analyses presented was high ozone events beginning in 2005 and 2006
   - High ozone events occur in winter (Feb-Mar).
   - These events are driven by rapid oil and gas development in a region that is surrounded by mountains on 3 sides.
   - Meteorology also plays a key role, esp. snow cover, low wind speeds, and multi-day inversion events with 100-150 meter mixing heights.
2. Field study undertaken to characterize meteorological conditions during ozone episodes
   - Airborne measurements to determine vertical and horizontal extent of high ozone.
   - UV radiation measurements.
   - Measurements of ozone precursor concentrations.
3. Emissions inventory improvements focused on oil and gas production sources
   - Number of wells in Sublette County has grown dramatically since the mid-90’s.
   - Wells/drill rigs often placed in close proximity to one another.
   - WY DEQ has undertaken an extensive minor source permitting program that covers all oil and gas wells in the state.
   - Emissions inventories are being developed on a well-by-well basis; include speciated hydrocarbon emissions.

Agenda for the August 24 meeting

- Review and provide comments on the synthesis memorandum to be distributed by Steve Reid of Sonoma Technology.
- Discuss follow-up questions on themes that emerged during the previous meetings:

1) What would be a recommended "first actions" checklist for other S/L's that want to develop local-scale emissions inventories? 2nd-order list?

2) How do local-scale emissions inventory improvements for SIP modeling purposes relate to your agency's submittals to the EPA NEI under the AERR, and do barriers to submitting these local-scale data exist? (Related: Is your agency familiar with EIS capabilities to accept detailed data on facility operations/configurations?)

3) Are there NEI analyses that could benefit local-scale EI efforts by state/local agencies *and* improve the NEI (e.g., routinely QA NEI data for residual or anticipated non-attainment areas, develop routines to look at NEI emissions for those areas using ambient measurements, wind trajectories, and met adjustments)?

4) What are the perceived benefits for focusing local-scale emission improvements on *multiple* pollutants - PM and O_3 precursors and associated toxics?

5) Would state/local agencies benefit from knowing the control implementations that are resulting from local-scale assessments in other areas? How would you have used such a clearinghouse of information (and is such a clearinghouse already available)?

Focus Group Meeting 7

Date: August 24, 2010
Time: 2:30 PM EDT

Core participants present:

- Steve Reid, Sonoma Technology
- Jayme Graham and Sean M., Allegheny County (PA)
- Leigh Bacon and Tim Martin, Alabama DEM
- Jim Boylan and Byeong Kim, Georgia DNR
- Brian Bohlman, Wyoming DEQ

Peer reviewers and other participants present:

- Alice Chow, EPA Region 3

Agenda

1. Provide comments on the technical memorandum circulated by Steve Reid that summarizes information presented by state and local agencies
2. Discuss follow-up questions that emerged from presentations by state and local agencies

Meeting Summary

Comments on technical memorandum:

- Some participants had not finished reviewing the memo.
- Participants were encouraged to email Steve (sreid@sonomatech.com) comments after reviewing the document.
- Additional findings and recommendations will be added to this document to form the final project report.

Discussion of follow-up questions:

1. What would be a recommended “first actions” checklist for other S/L's that want to develop local-scale emissions inventories? 2nd-order list?
   Source Identification/Prioritization:
   - Start with what you know about source(s) that may be impacting ambient concentrations and, therefore, in need of controls. Analyze to verify source impacts.
   - List key local sources and begin assessing them with a simple analysis like Q/D. From there, a “weight of evidence” approach is best, with PMF and wind direction analyses being especially helpful.
   - Understand your speciation data—how do species vary diurnally, seasonally?
   - Make sure sources are adequately characterized for modeling (evaluate stack parameters, emissions characteristics for non-point sources).
   - In some cases, monitoring data alone is sufficient to point to source culpability.

   Emissions Inventory Development:
   - Good communication with owners/operators of individual facilities is critical (echoed by multiple agencies).

- Communication with agencies in other states with similar issues is important, too.
- Identify parties you need data from. Thoroughly QA any data you receive (i.e., do production rates, operating parameters make sense?).
- Work with permit and facility engineers to see if reported emissions are reasonable for a given facility type.
- It may be necessary to hire a consultant to help assemble the inventory.

2. How do local-scale emissions inventory improvements for SIP modeling purposes relate to your agency's submittals to the EPA NEI under the AERR, and do barriers to submitting these local-scale data exist? (Related: Is your agency familiar with EIS capabilities to accept detailed data on facility operations/configurations?)
   - In some cases, there is no relationship between local-scale EIs and NEI submittals, partly due to timing issues (most recent submittal complete when local-scale work began).
   - Preparing detailed local-scale data for submittal is labor intensive.
   - Local-scale data may be useful for local area analyses but not important for regional modeling conducted by other states.
   - Some sources evaluated for local area analyses were below the emissions thresholds for treatment as point sources in the NEI.
   - Modeling inventories tend to be developed on a separate track from the inventories submitted to EIS.
3. Are there NEI analyses that could benefit local-scale EI efforts by state/local agencies and improve the NEI (e.g., routinely QA NEI data for residual or anticipated non-attainment areas, develop routines to look at NEI emissions for those areas using ambient measurements, wind trajectories, and met adjustments)?
   - It may be necessary to assess the suitability of EIS formats for western states (e.g., large compressor stations with no physical address).
   - The need for updated emissions factors is a big issue for some sources.
4. What are the perceived benefits for focusing local-scale emission improvements on multiple pollutants – PM and ozone precursors and associated toxics?
   - Learning more about a source's configuration is beneficial for all pollutants, though the main focus may be $PM_{2.5}$.
   - Some efforts are being put into collecting data on air toxics in tandem with ozone or $PM_{2.5}$ precursors.
5. Would state/local agencies benefit from knowing the control implementations that are resulting from local-scale assessments in other areas? How would you have used such a clearinghouse of information (and is such a clearinghouse already available)?
   - Guidance on controls tends to be internal and resides with permit staff.
   - There is some sharing of information on controls between states, but this tends to happen through individual contacts with staff at other agencies or consultants.
   - EPA (http://cfpub.epa.gov/RBLC/) has an online controls clearinghouse and websites for state/local permit staff.

Additional Question: What is the relationship between modelers and emissions staff at your agency? How closely do they work together on local-scale analyses?

- In some cases, a single database exists with emissions data, permit data, and stack parameters, so all staff draw from the same source for EIS submittals, emissions for modeling, etc.

- In other cases, modelers work with emissions staff to get a starting point for emissions estimates. But they do not continue working together throughout the process, as modeling inventories tend to evolve along a different tangent using information obtained from permitters or facilities.
- Emissions staff may be asked to review modeling inventories to ensure that they make sense (e.g., are emissions rates within allowable limits?).
- Emissions and modeling staff work together on inventories for most source sectors, but point sources may be handled by permit staff (who are not always informed of inventory changes developed for modeling purposes).

APPENDIX B

Presentations by State and Local Agencies to the Local-Scale Emissions Focus Group

List of Presentations

Alabama's Local Emissions Inventory Experience

CMAPS Emissions Inventory Development

Allegheny County (PA) Local Scale Emissions Inventory for PM2.5 Modeling

Local-scale PM2.5 Modeling in Atlanta

Granite City, IL $PM_{2.5}$ Nonattainment: Regional and Local-Scale Modeling, Data Analysis, and Emissions Control Developments

Ozone Events in the Upper Green River Basin of Southwestern Wyoming

Alabama's Local Emissions Inventory Experiences

Leigh Bacon and Lisa Cole

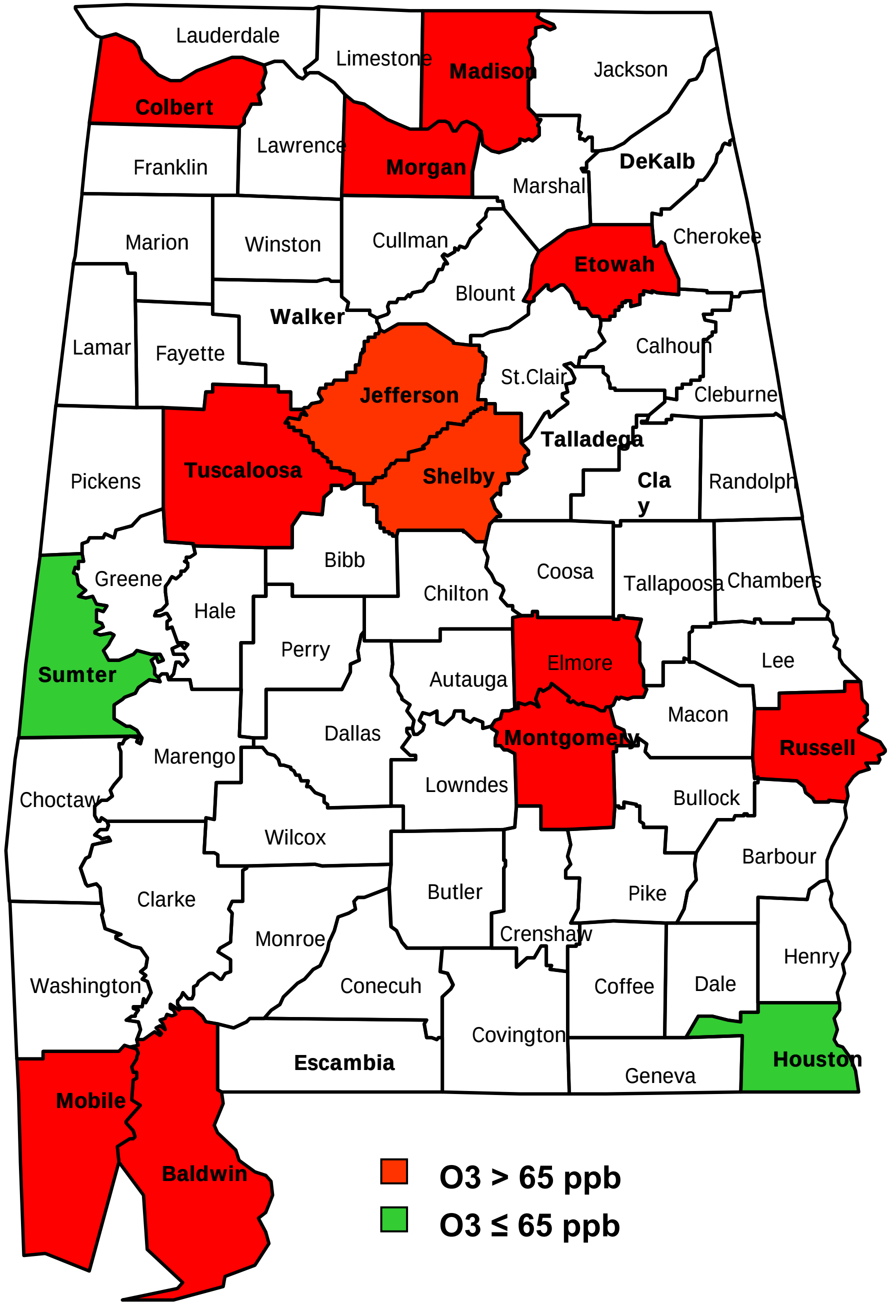
ADEM Air Division

June 29, 2010

Charge Question #1

- **What type of air quality problems are you trying to solve with fine scale modeling?**
- In the past, modeling was completed for the Birmingham area only for 1 hour O_3 and Annual $PM_{2.5}$.
  - Ozone scale was 12 km; PM2.5 scale was 4 km supplemented with AERMOD grids over the NA monitors
- ADEM expects that fine scale modeling will be needed for the revised O_3 standard for several areas of the State, dependent on the level of the standard, and perhaps $PM_{2.5}$ in the future.

8-Hour Ozone Design Values
2007-2009



Charge Question #2

- **Are there analysis techniques that have been useful to help validate emission bias, identify key sources in the area and prioritize the inventory improvement work?**
- Focusing specifically on the Annual $PM_{2.5}$ problems in Birmingham, there were several beneficial analyses that were used to id key sources, including:
  - ENVAIR report
  - VISTAS Sensitivities
  - Q/D analyses
  - AERMOD modeling (railyards, bouyant volume sources)

Charge Question #3

- **Which source categories did they improve and what methods did they use?**
- In the past, most of the improvement came in the point source inventory
  - Stack parameters, emission rates, locations
- Since that time, a lot of work has been put into improving the area source inventory, the fire inventory and the mobile inventory
  - Better characterization, closer evaluation of sources that have never been evaluated to that degree

Charge Question #4

- **What kind of before/after differences in emission estimates and modeling results did you see?**
- For the BAPS work, we saw significant differences in the point source emissions and impacts associated with revising stack parameters
- While our area, fire and mobile work is ongoing, we believe that independent of impact differences, that our inventory is a better one for having worked on these categories.

Charge Question #5

- **Are there NEI analyses that would be particularly helpful to their efforts?**
- The NEI lacks the quality that is needed for local area analyses
  - NEI inventories are good **starting points** for large scale modeling analyses (RPO work)
  - Local Scale analyses are so specific, that for BAPS we created our own inventory
    - Very time and resource intensive
- As standards get tightened, agencies will have to create local inventories for their SIPS
- Are we expecting too much from the NEI?

CMAPS Emissions Inventory Development

Steve Reid
Manager, Emissions Assessment
Sonoma Technology, Inc.
Petaluma, CA

Presented to the
Local-Scale EI Focus Group

June 29, 2010

Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

Presentation Outline

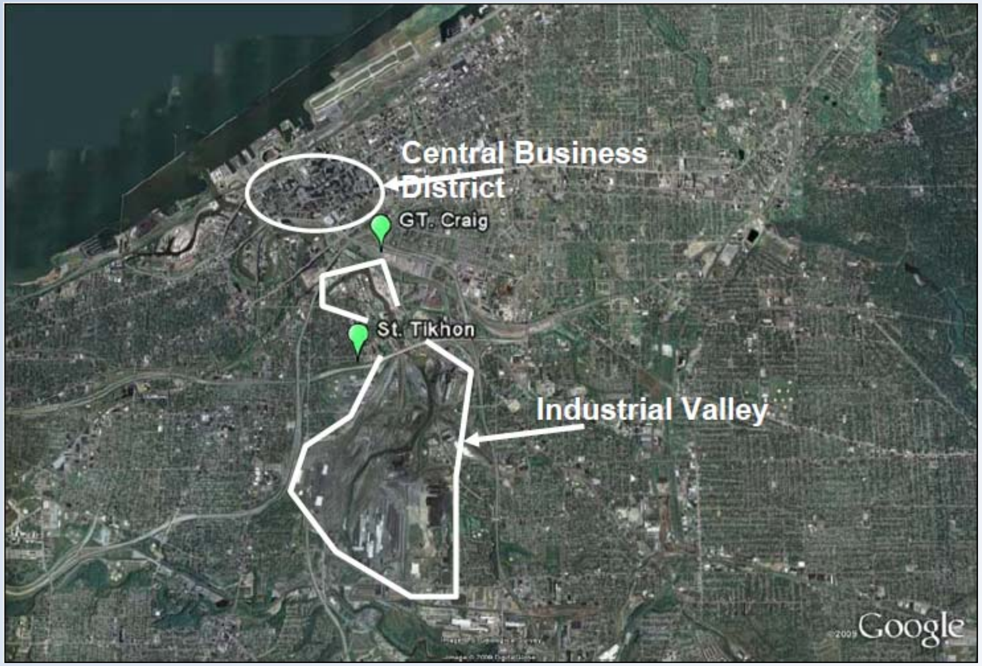
- Project background
- Emissions inventory development
  - Overview
  - Development steps
  - Emissions modeling
- Summary of results
  - Preliminary emission changes
  - Charge questions

CMAPS Background (1 of 4)

The Cleveland Multiple Air Pollutant Study (CMAPS) is a year-long measurement and modeling study designed to investigate sources of air pollution in the Cleveland metropolitan area.

Partners include:

- EPA Office of Research and Development (ORD)
- Cleveland Division of Air Quality (CDAQ)
- Akron Region Air Quality Management District
- Ohio EPA
- Contractors: (Alion and Sonoma Technology)

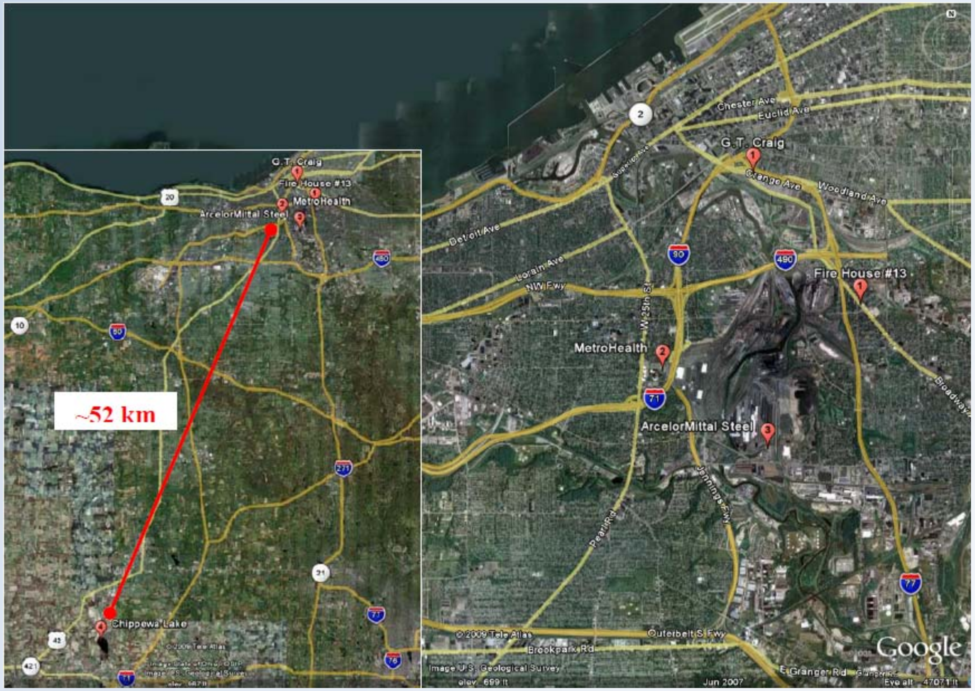


STi
Sonoma Technology, Inc.

CMAPS Background (2 of 4)

Technical Approach:

- Year-long (9/2009 – 9/2010) PM and Hg measurements at 3 urban and 1 background site;
- Two intensive monitoring periods (9/2009 & 2/2010) to measure additional pollutants (CO, SO_2, BC, NH_3, etc.)
- Intensive periods include the placement of passive monitoring devices at 20 fire stations
- Meteorological measurements collected at a site in Industrial Valley



CMAPS Background (3 of 4)

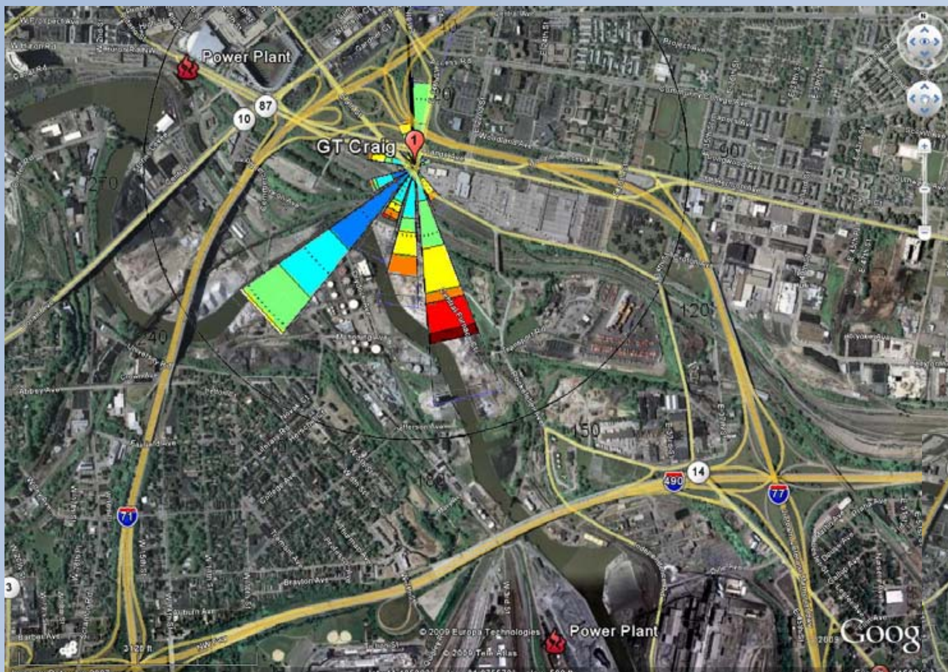
Technical Approach:

- Receptor modeling with Chemical Mass Balance (CMB), Positive Matrix Factorization (PMF), and Unmix
- Photochemical grid modeling with WRF and CMAQ

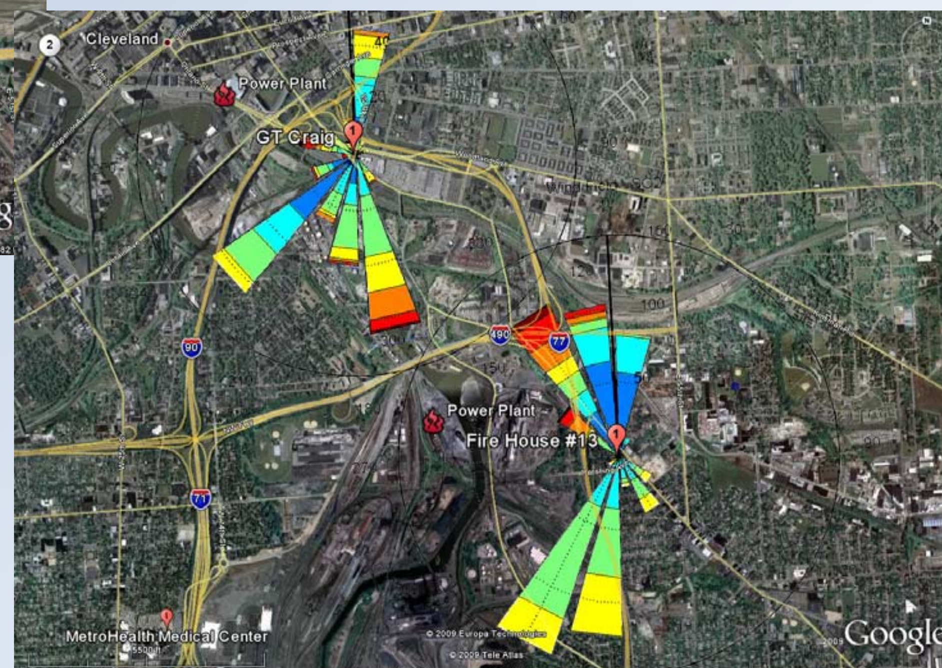
CMAQ Emissions Inputs:

Update the 2005 NEI to make the inventory more representative of the CMAPS study period for key sources in Cleveland and the region (e.g., industrial sources, power plants, on-road mobile sources)

CMAPS Background (4 of 4)



SO_2 pollution roses show impact of power plants and industrial sources

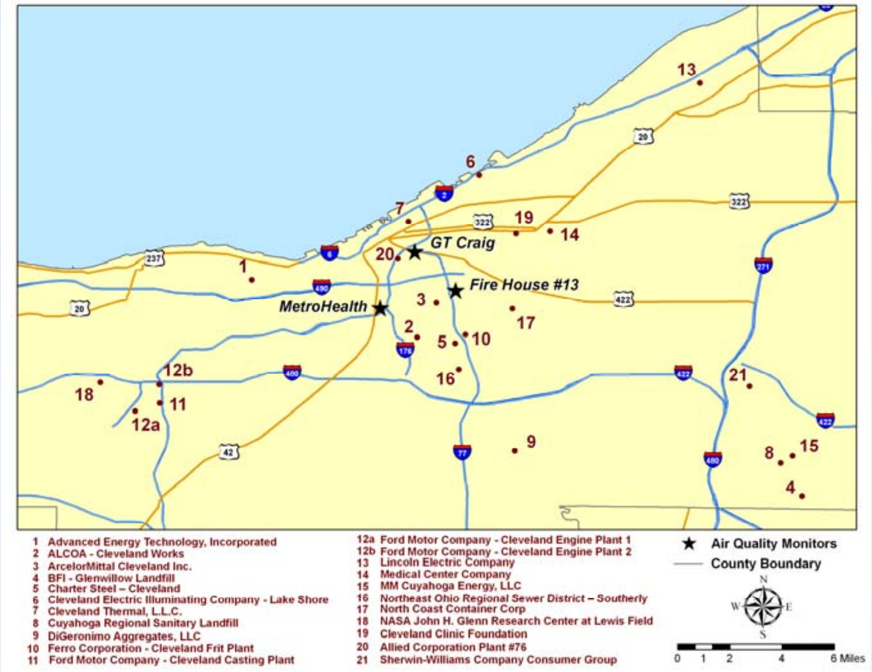


NO_2 pollution rose shows impact of roadways and industrial sources

Emissions Inventory Development (1 of 5)

Point sources:

- 21 key Cleveland facilities
  - Identified by CDAQ and EPA
  - Invited to March meeting at CDAQ
  - Follow-up survey by phone and email
  - Data collected from 17 of 21 facilities



Data requested included:

- 2009 annual emissions
- Monthly production/fuel combustion
- Daily production/fuel combustion for Aug 2009 and Feb 2010

Sonoma Technology, Inc.

Emissions Inventory Development (2 of 5)

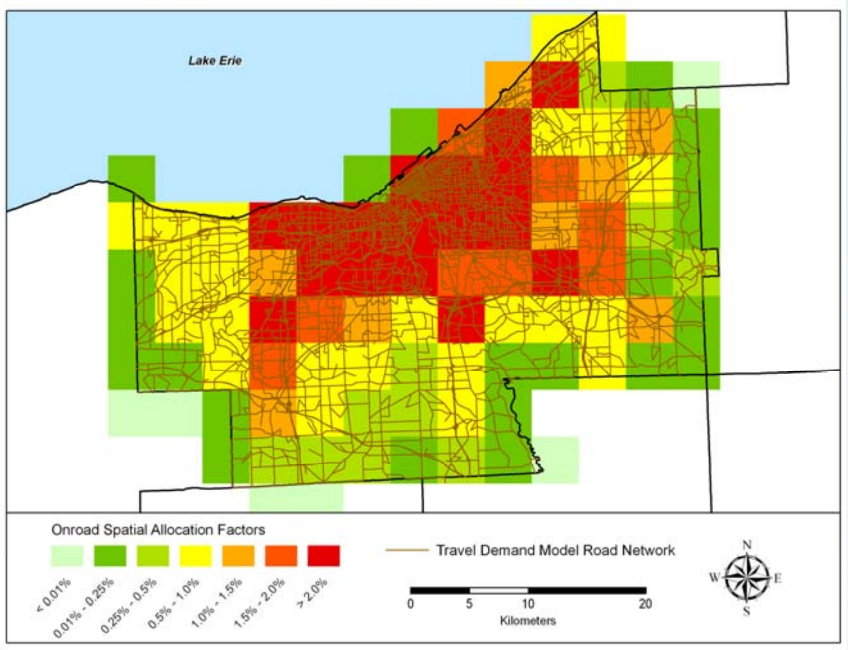
Point sources:

- Regional power plants
  - Focus on Ohio and western parts of PA and WV (52 facilities)
  - Obtained monthly SO_2/NO_x emissions and heat input for 2009 and 1st quarter of 2010 from EPA's Clean Air Markets Division (CAMD) database
  - Scaled Hg emissions based on heat input; reduced Hg^{2+} emissions by 95% for units with wet FGD systems installed since 2005

Emissions Inventory Development (3 of 5)

On-road mobile sources:

- Acquired 2009 travel demand model outputs from the Northeast Ohio Areawide Coordinating Agency (NOACA)
- Used TDM VMT data to update MOVES county database and develop 4-km SAFs
- Updated MOVES met data for Cuyahoga County
- Ran MOVES for all counties in the 4-km modeling domain

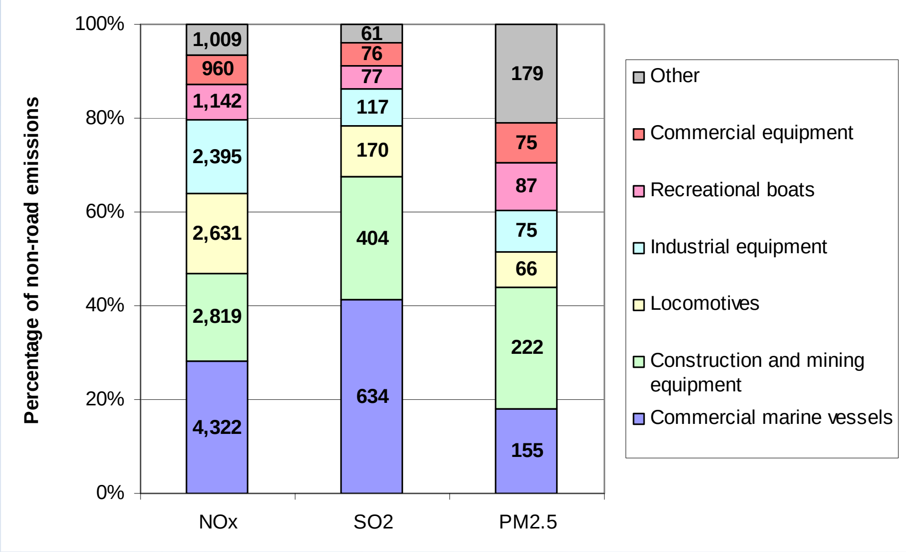


STi Sonoma Technology, Inc.

Emissions Inventory Development (4 of 5)

Non-road mobile sources:

- Analyzed 2005 NEI to determine key sources (CMV, construction equipment, locomotives)
- Contacted Port of Cleveland, CSX and Norfolk Southern railroads, and Cleveland Planning Department
- Only able to gather port data in time for use in EI development

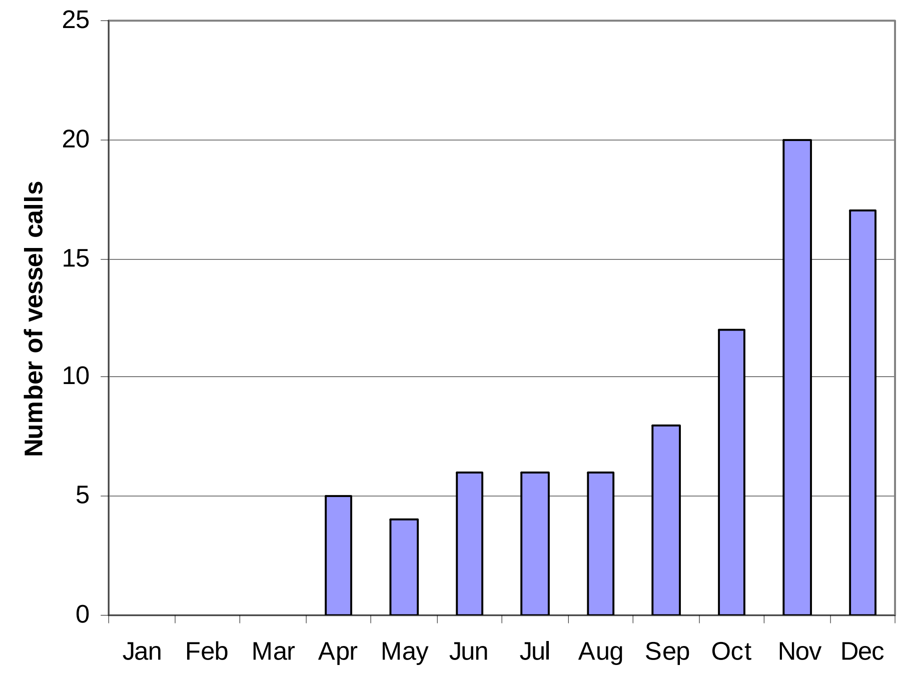


STI
Sonoma Technology, Inc.

Emissions Inventory Development (5 of 5)

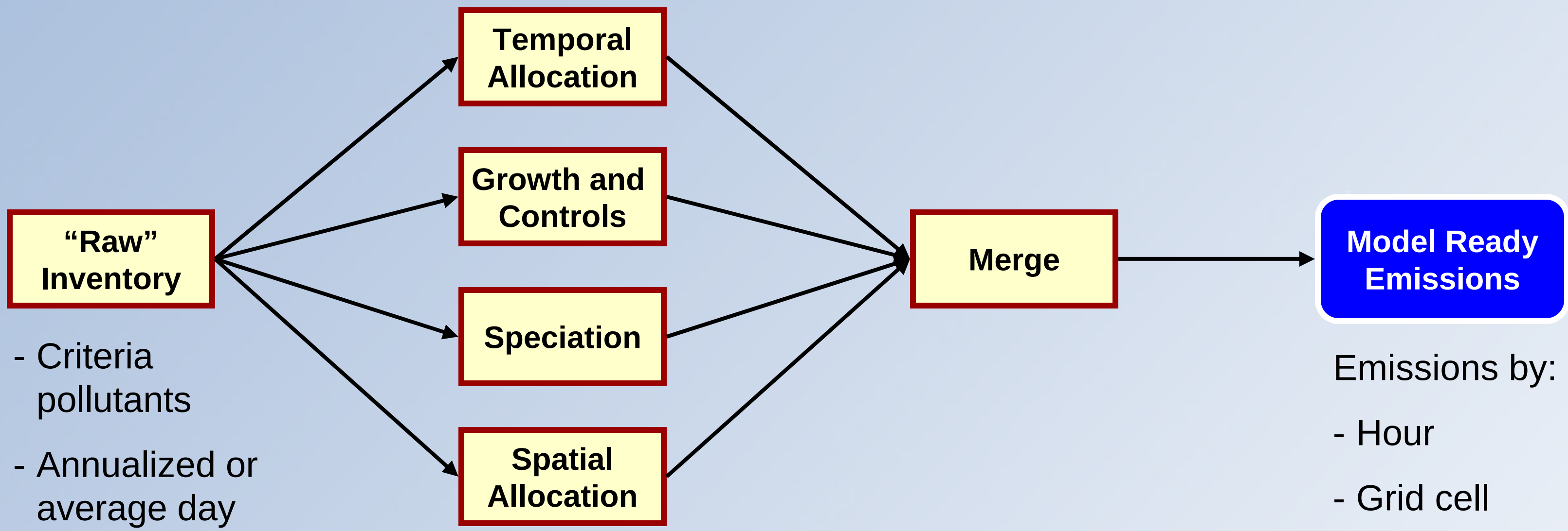
Non-road mobile sources:

- During 2009, vessel traffic at the Port of Cleveland was at a 50 year low (91% lower than in 2005)
- 2005 emissions scaled based on vessel calls
- Monthly emissions profile developed from 2009 vessel call data



STi
Sonoma Technology, Inc.

Emissions Modeling (1 of 3)



- Criteria pollutants
- Annualized or average day emissions
- County-level resolution
- Reported by source type

Emissions by:

- Hour
- Grid cell
- Vertical layer
- Model species

Emissions Modeling (2 of 3)

Starting point:

- EPA's 2005-based modeling platform, version 4

Growth and Controls

- Adjusted 2005 emissions for point, on-road, and non-road sources to account for 2009/2010 activity levels

Spatial Allocation

- Verified the location of key point sources using Google Earth
- Re-projected EPA's default 4-km surrogates to match the CMAPS modeling domain
- Developed SAFs for on-road mobile sources based on NOACA's TDM outputs
- Development of 1-km surrogates pending

Sonoma Technology, Inc.

Emissions Modeling (3 of 3)

Temporal Allocation

- Developed day-specific emissions files for August 2009 and February 2010 for key point sources
- Developed monthly profiles for power plants and commercial marine vessels

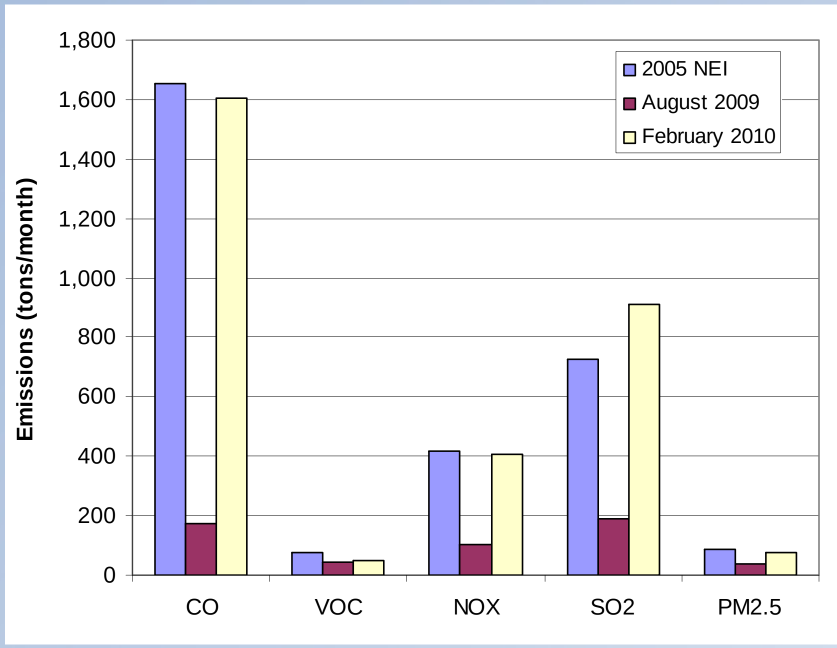
Speciation

- Updated SMOKE's inventory tables and speciation profiles to include the full range of species to be modeled by EPA

Ran SMOKE to produce CMAQ-ready emissions files for the CMAPS 4-km domain for:

- July 21 – August 31, 2009
- January 22 – March 2, 2010

Summary of Results (1 of 2)

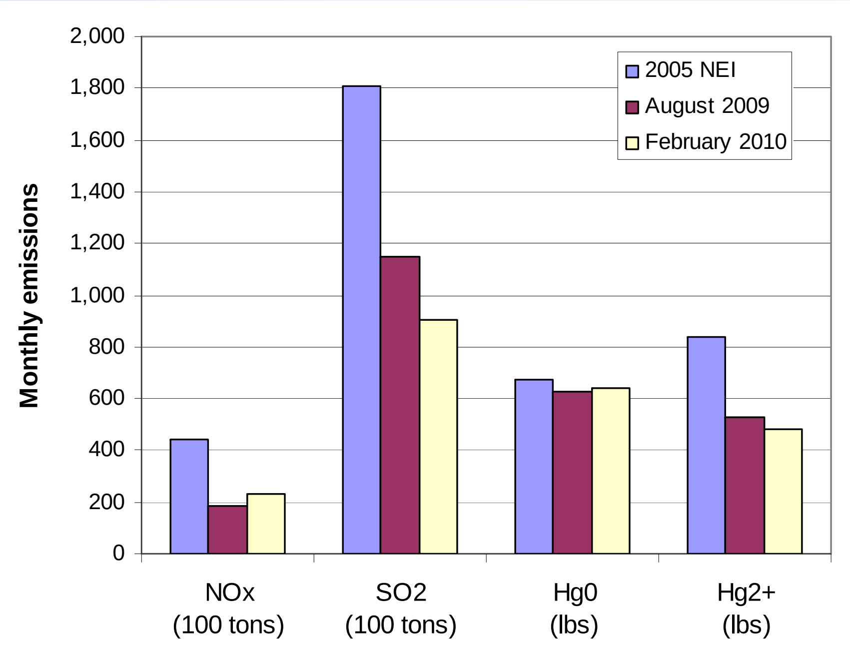


Key facilities in Cleveland:

- August 2009 emissions 39-90% lower than 2005 levels (steel mill and power plant not active in August)
- February 2009 emissions comparable to 2005 levels (±30%)

Regional power plants:

- SO_2, NO_x and Hg^{2+} emissions 37% - 58% lower than 2005 levels during the two intensive months



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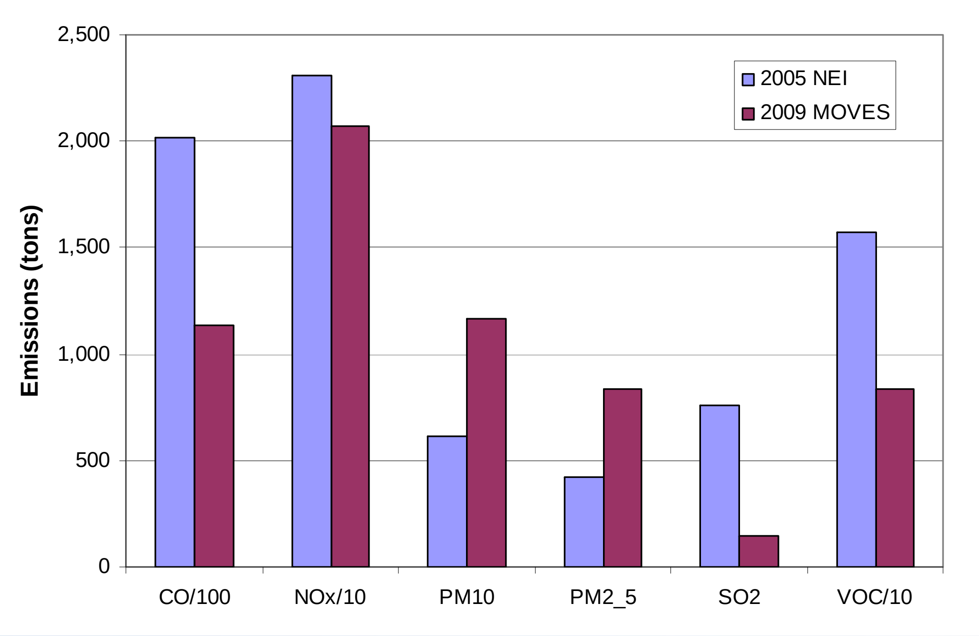
Summary of Results (2 of 2)

On-road mobile sources:

- Significant reductions in CO, SO_2, and VOC compared to 2005 NEI
- Slight decrease in NO_x and actual increases in PM
- Consistent with other comparisons of MOBILE6 and MOVES



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Charge Questions (1 of 2)

1. What type of air quality problems are they trying to solve with their fine-scale modeling?
   - Cleveland has 2 $PM_{2.5}$ nonattainment sites (24-hr and annual)
   - Complex source mix – want to determine relative contributions (toxics)
2. Are there any analysis techniques that have been useful to help validate emission biases, identify key sources in their area, and prioritize the inventory improvement work?
   - Review of preliminary monitoring results (pollution roses)
   - Review of existing emissions data (2006 CDAQ point source inventory)
   - Prioritization of regional coal-fired boilers for Hg

Charge Questions (2 of 2)

3. Which source categories were improved and what methods were used?
    - Local industrial sources (surveys)
    - Regional power plants (CAMD data)
    - Mobile sources (TDM outputs, local activity data)
4. What kind of before/after differences in emission estimates and modeling results were seen?
    - Significant reductions in local industrial emissions for Aug 2009
    - Significant reductions in regional power plant emissions
    - Modeling results pending
5. Are there any NEI analyses that would be helpful?

Questions & Discussion

Allegheny County (PA) Local Scale Emissions Inventory for PM2.5 Modeling

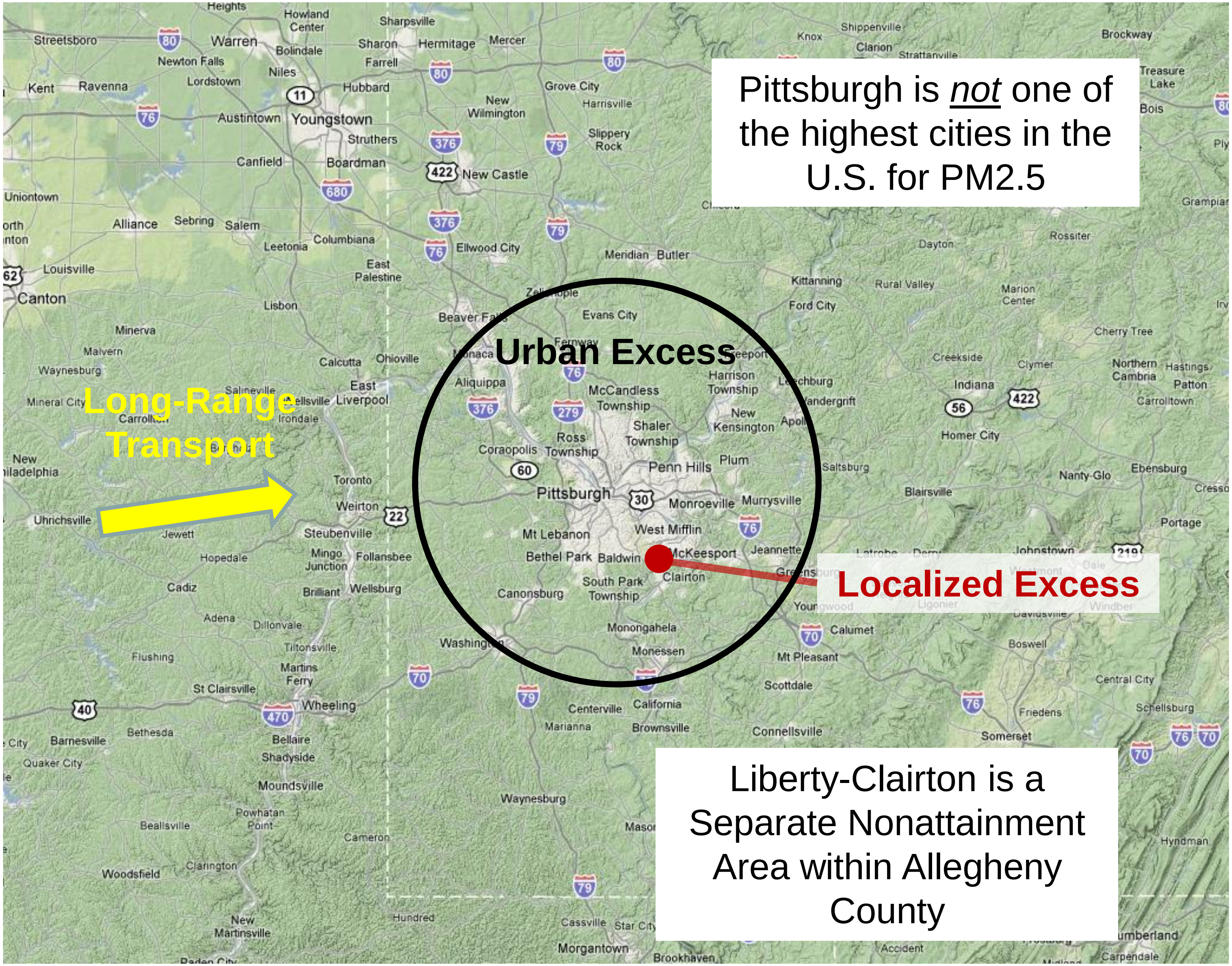
Local Scale Emissions Inventory Focus Group

July 13, 2010

Jason Maranche
Jayme Graham

ACHD Air Quality Program
Pittsburgh, PA

PM2.5 in Southwestern PA



Pittsburgh is *not* one of the highest cities in the U.S. for PM2.5

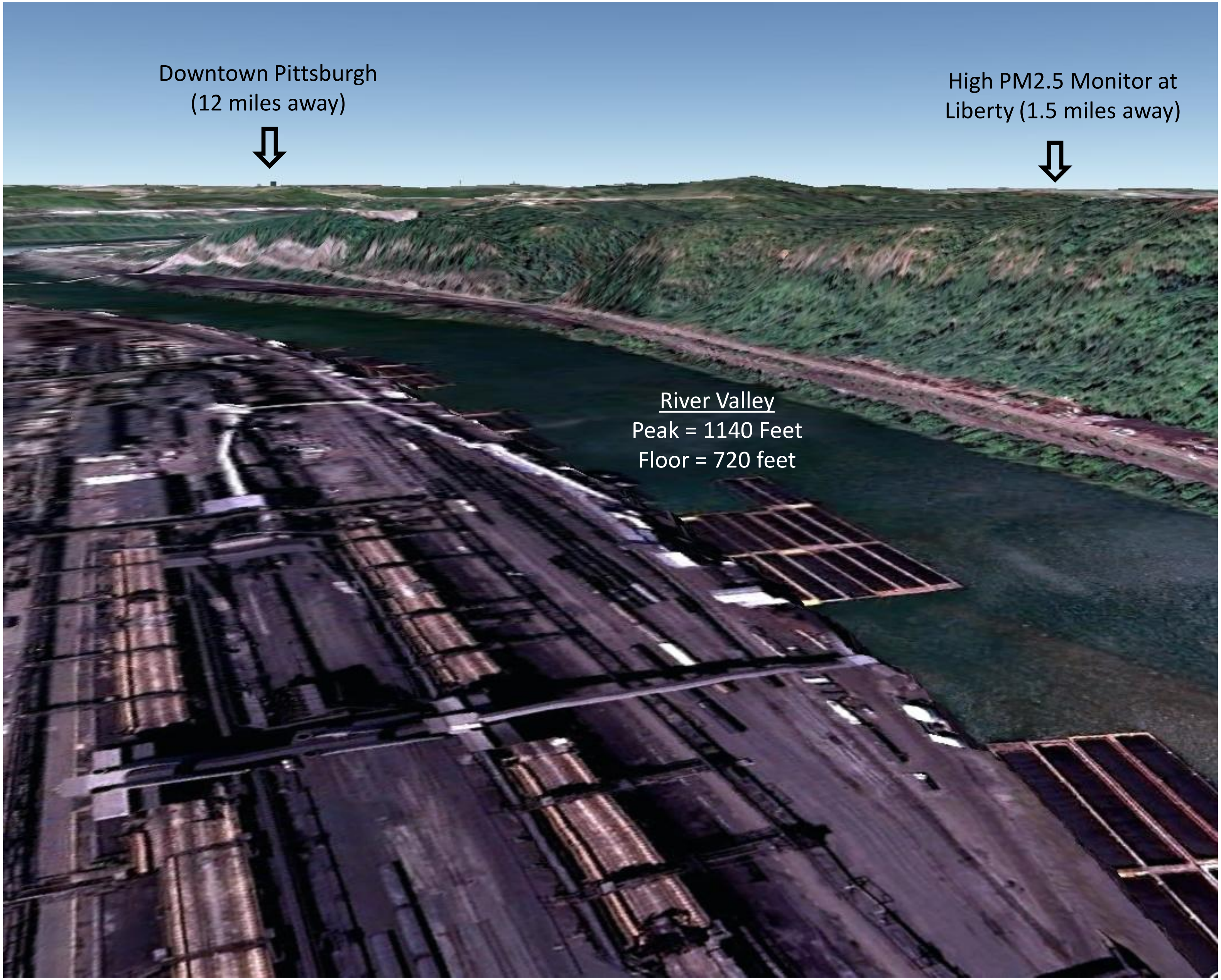
Liberty-Clairton is a Separate Nonattainment Area within Allegheny County

SW PA PM2.5 Designations

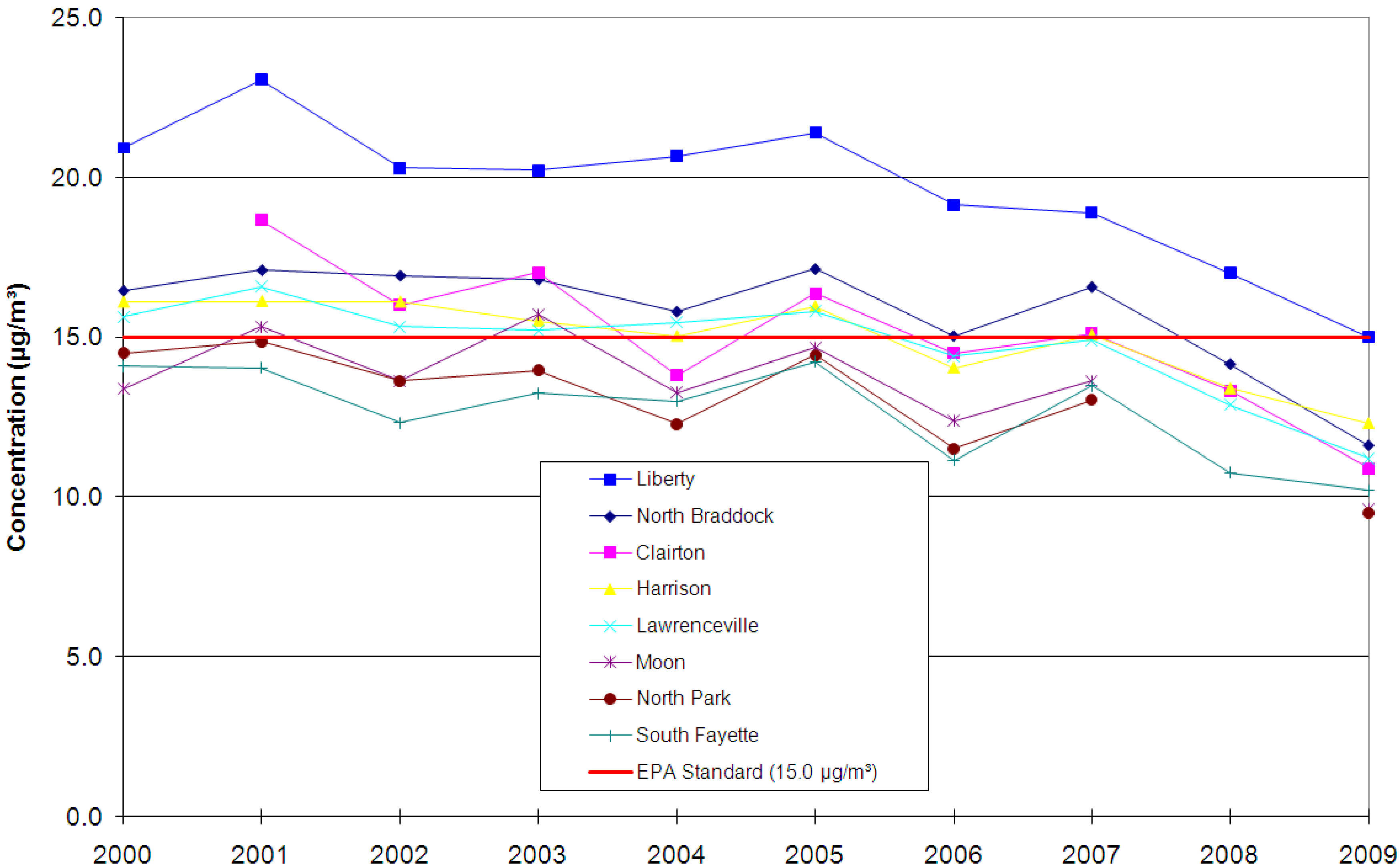
Pittsburgh – Beaver Valley Area: includes all of Allegheny, Beaver, Butler, Washington, and Westmoreland Counties, and parts of Armstrong Co. (Washington Twp., Plumcreek Twp., and Elderton Borough), Greene Co. (Monongahela Twp.), and Lawrence Co. (Taylor Twp. south of New Castle)

Liberty – Clairton Area: includes Glassport, Liberty, Lincoln and Port Vue Boroughs, and City of Clairton

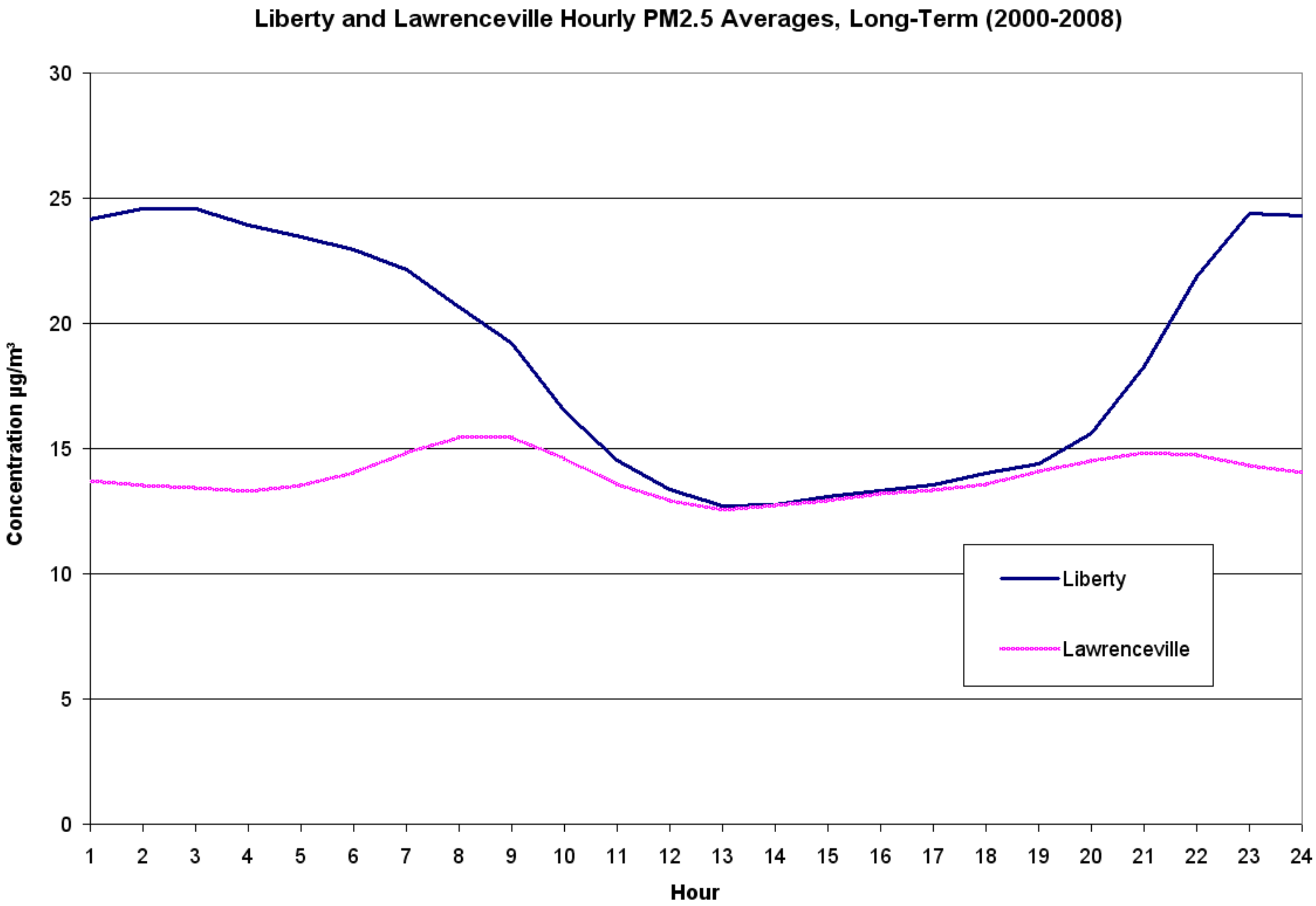
Google Earth View of River Valley



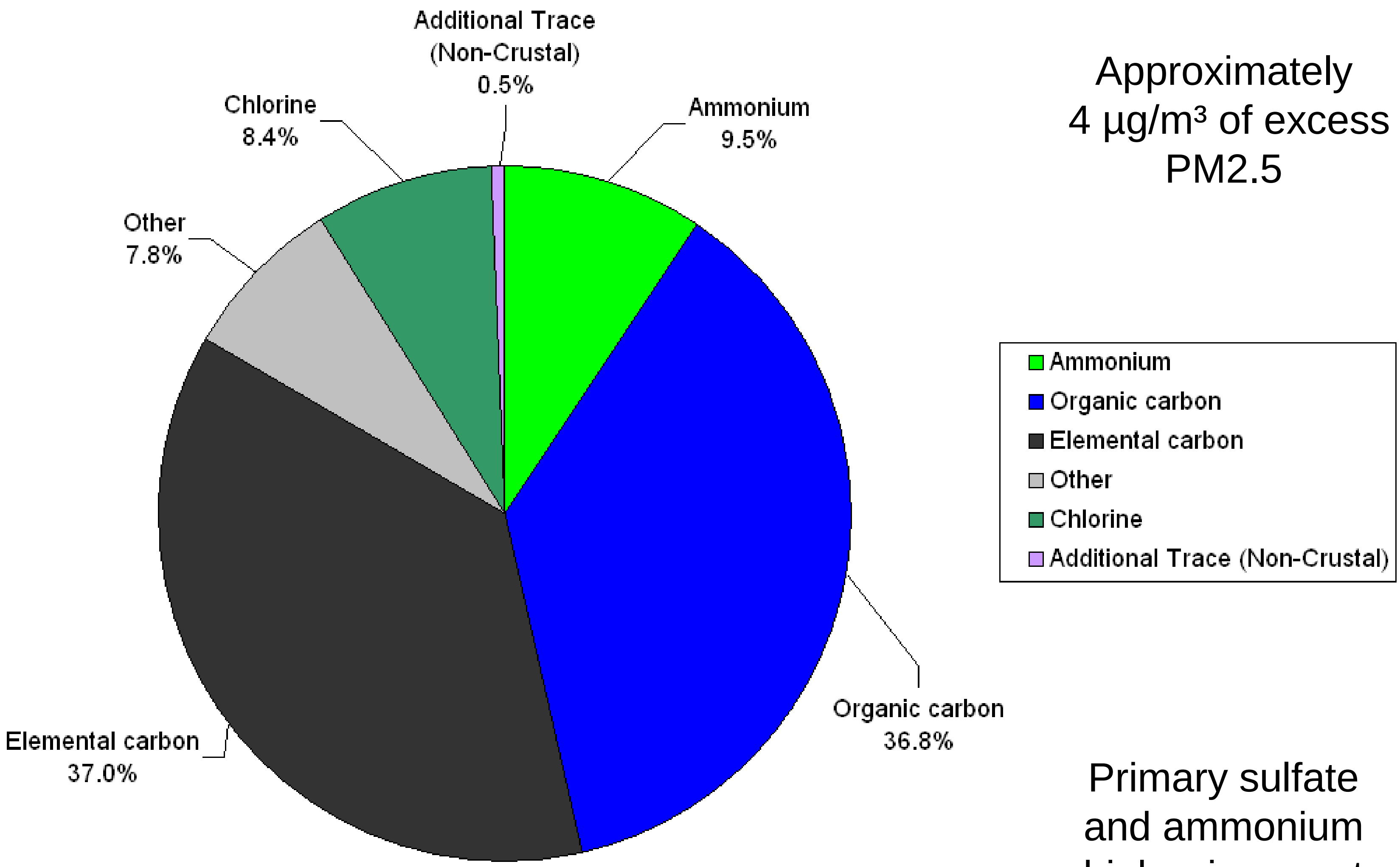
Allegheny County Annual Avg PM2.5 by Year



TEOM Data for Liberty and Lawrenceville [Urban]



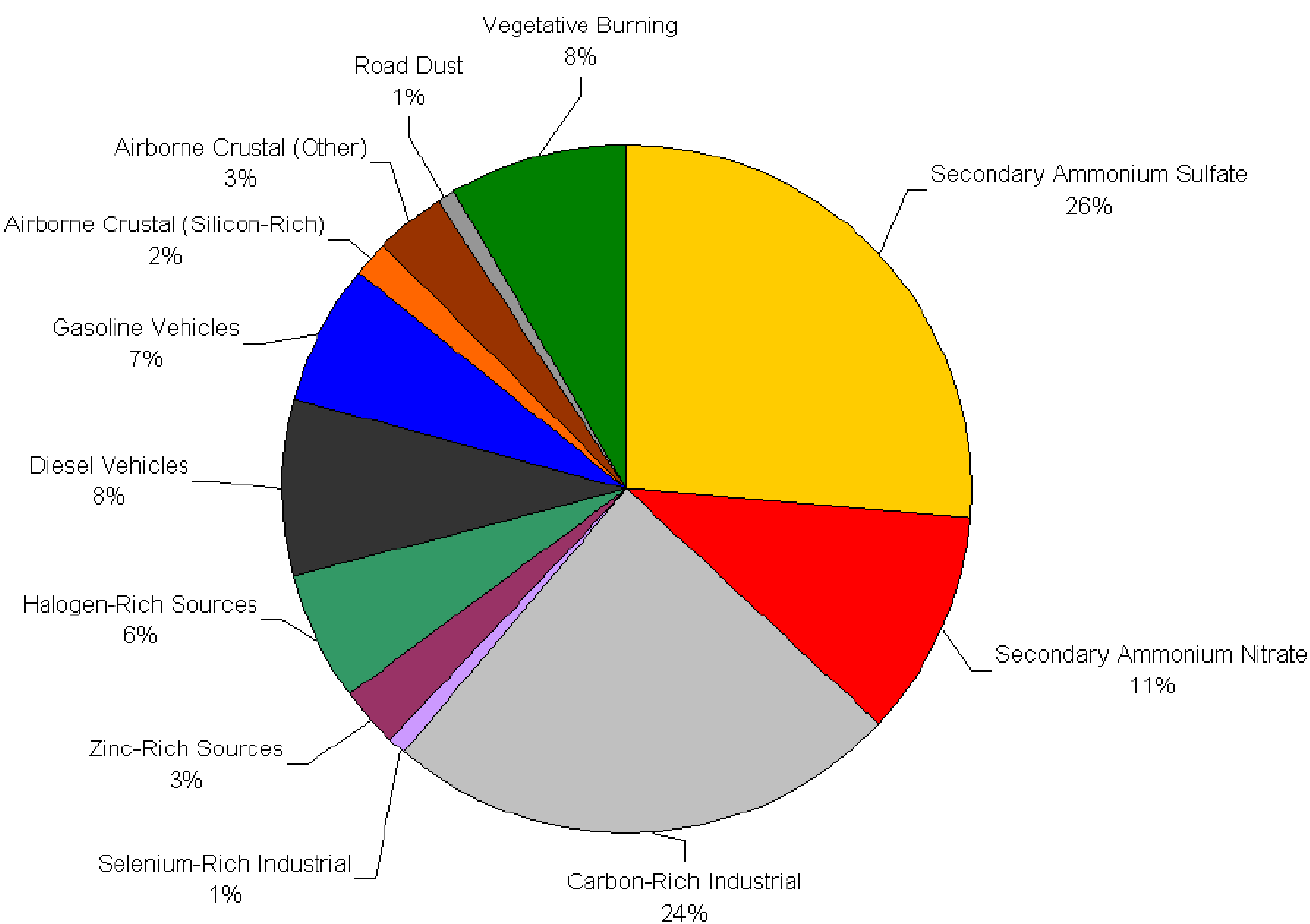
PM2.5 Excess Species



Approximately 4 µg/m³ of excess PM2.5

Primary sulfate and ammonium higher in recent years

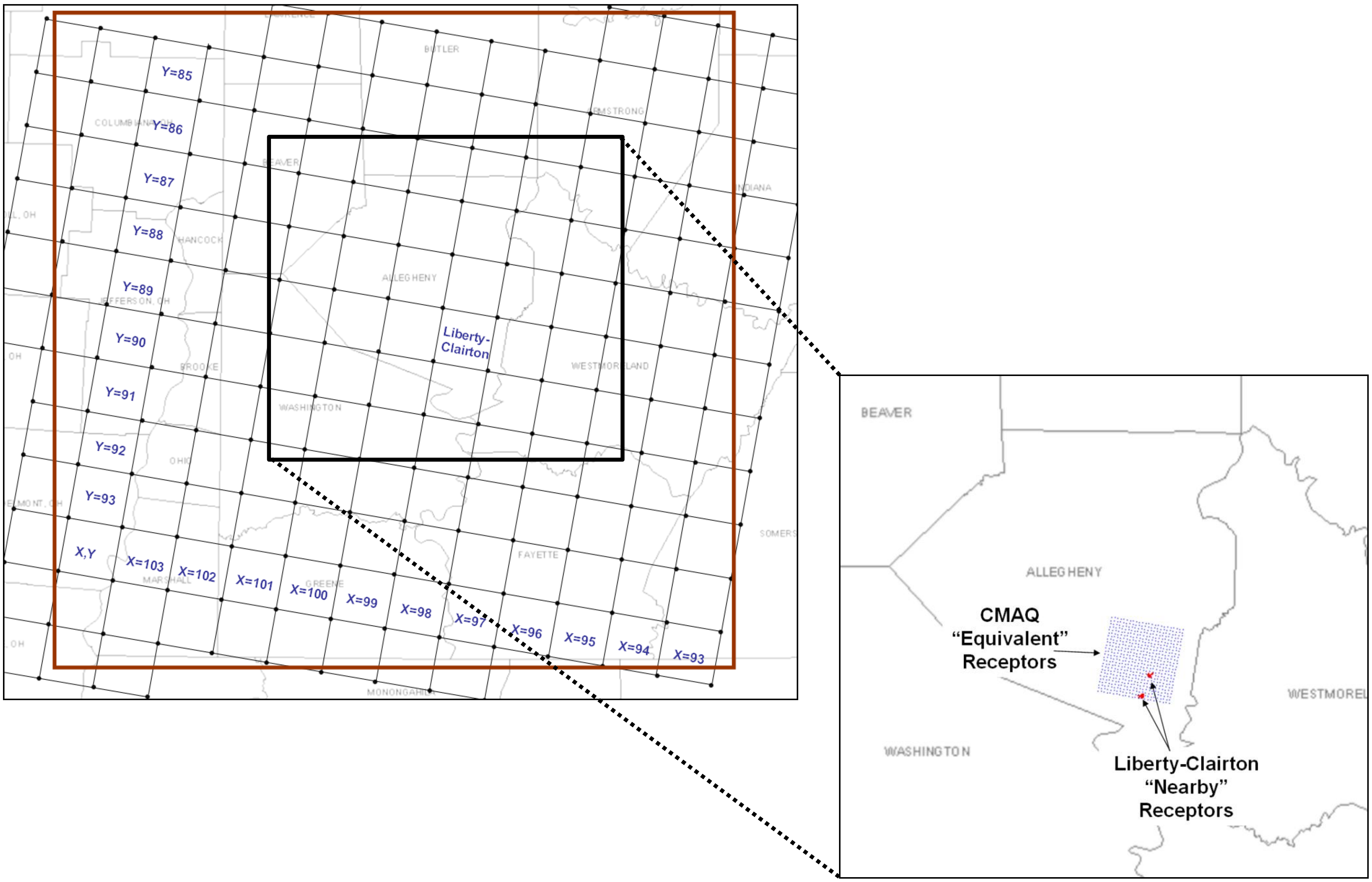
PMF Receptor Modeling - Liberty



Local Modeling Methodology

- Model primary PM2.5 only
- Combine regional with local modeling without double-counting
- CALPUFF used for local modeling due to buoyant line algorithms, stagnation, gridded met
- Model both near-field and long-range to account for all impact gradients throughout CMAQ 12-km grid cell
- Model using revised local emissions, source type, coordinates, etc.

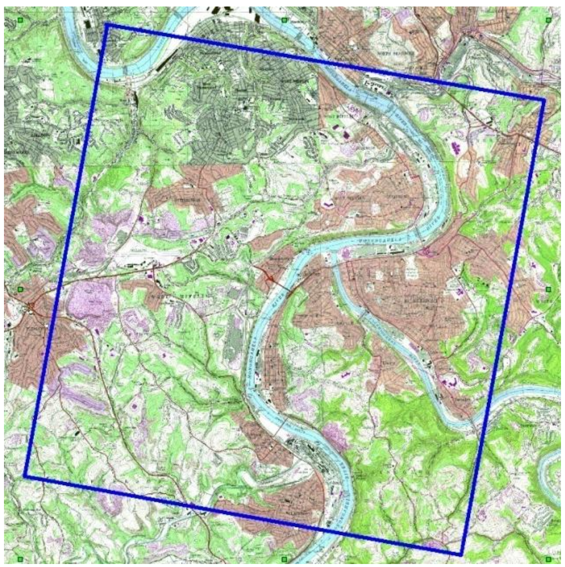
CMAQ and Local Modeling Grids



Combination of Impacts

- Based on 2004 Philadelphia air toxics study:

$$\text{CMAQ} \quad - \quad \text{LOCAL}_{\text{CMAQ-Equivalent}} \quad + \quad \text{LOCAL}_{\text{Nearby}}$$



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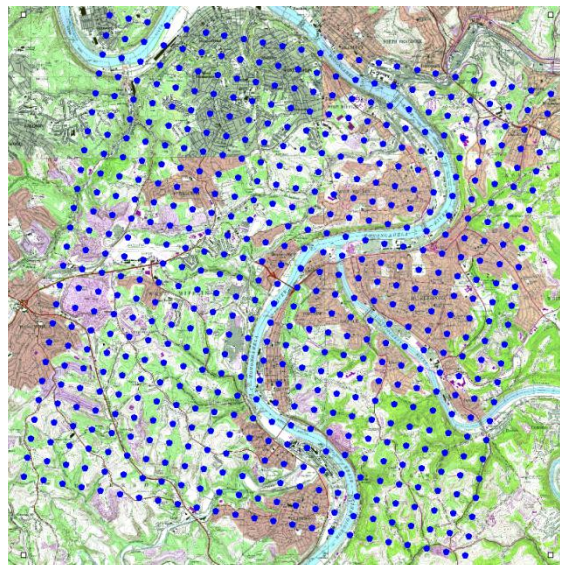

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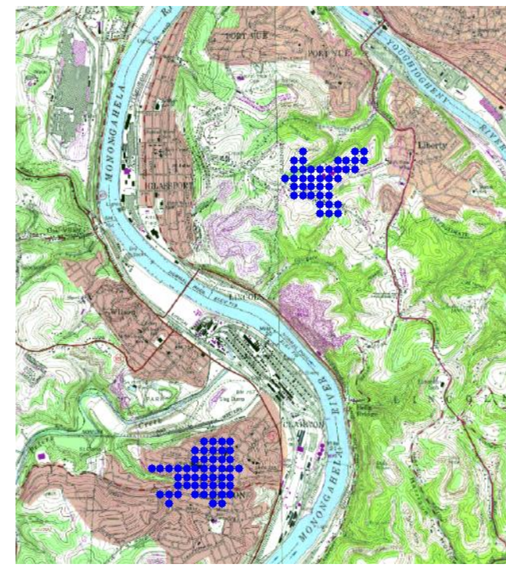
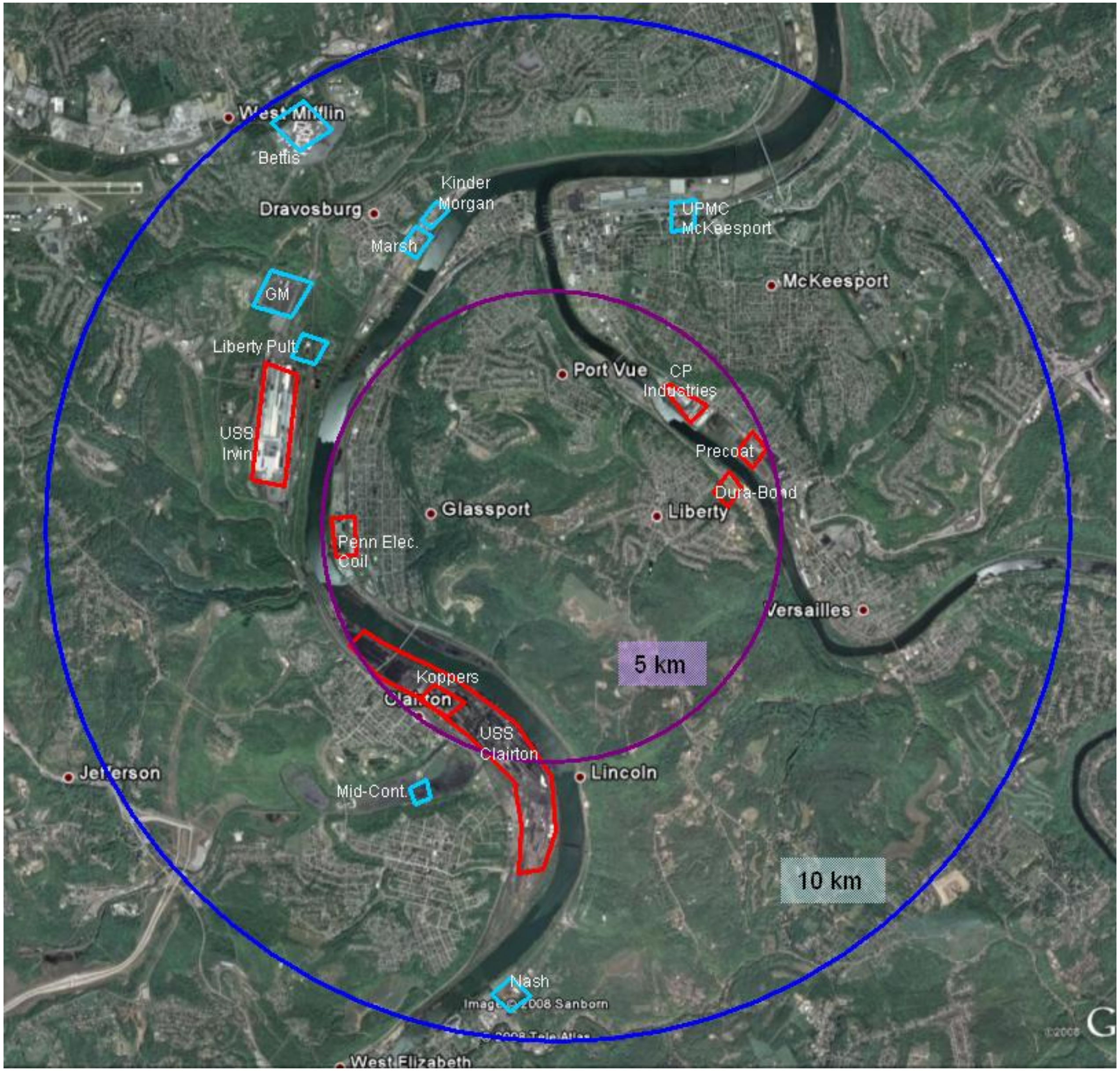


MANE-VU Inventory

MANE-VU Inventory

ACHD Inventory

Near-Field Sources



Sources in red include significant revisions to emissions, stacks, source type, coordinates

Local Inventory

- Most important revisions made to coke plant emissions

- Recent source test revised the emission factor for quench tower condensibles from 0.00031 lb/ton to 0.56 lb/ton – very large increase in what was missing from previous local modeling

- Baffle washing at quenches led to decrease in factor for filterable PM2.5 from 0.31 lb/ton to 0.0785 lb/ton – used for future controls

- Added soaking emissions from coke batteries

- Revised underfiring emissions based on cyclone in place of SSCEM method, increasing factor from 0.15 lb/ton to 0.82 lb/ton

Local Inventory (cont.)

- Revised methodology for traveling hot car emissions
- Revised pushing fugitive capture efficiencies
- Revised PM fractions for material handling, coal/coke pile erosion, paved and unpaved roads
- For future case: <u>remove</u> 2 old coke batteries, <u>install</u> 2 new coke batteries based on German Uhde design
- Includes new quench towers, showing large reductions in condensibles

Distant Inventory

- Future sources do not show concentration gradient like near-field sources but have overall impact on area

- Baseline condensible emissions added to local modeling if missing from regional CMAQ inventory

- EGUs were revised based on known future projects, updated stack tests, newer projections

- Stack parameters and coordinates corrected to ensure proper transport in model

Future SIP Modeling

- AERMOD model for local (enhancements needed), or fine-scale CMAQ/CAMx (eliminates combination)?
- Additional stack testing, different source characteristics?
- Model other excess species, use different method for combining?
- Additional supporting analyses needed (tracer studies, apportionment)?

Local-scale PM2.5 Modeling in Atlanta

James Boylan
(Georgia EPD – Air Protection Branch)

EIAG Project: Local-scale Emissions Inventory
July 13, 2010

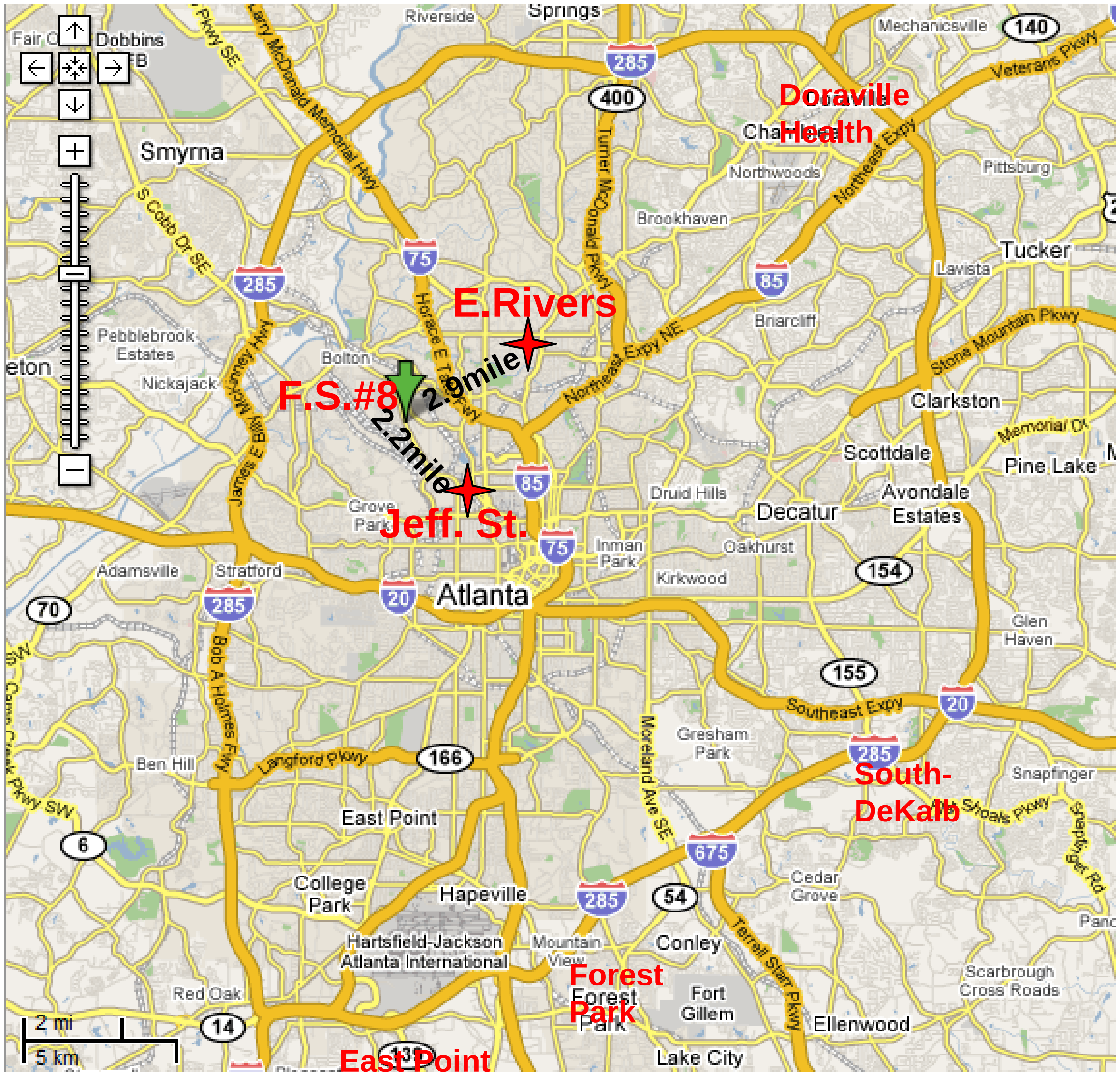
Outline

- Background
- Local Emission Sources
- Modeling Results
- Charge Questions

Objective

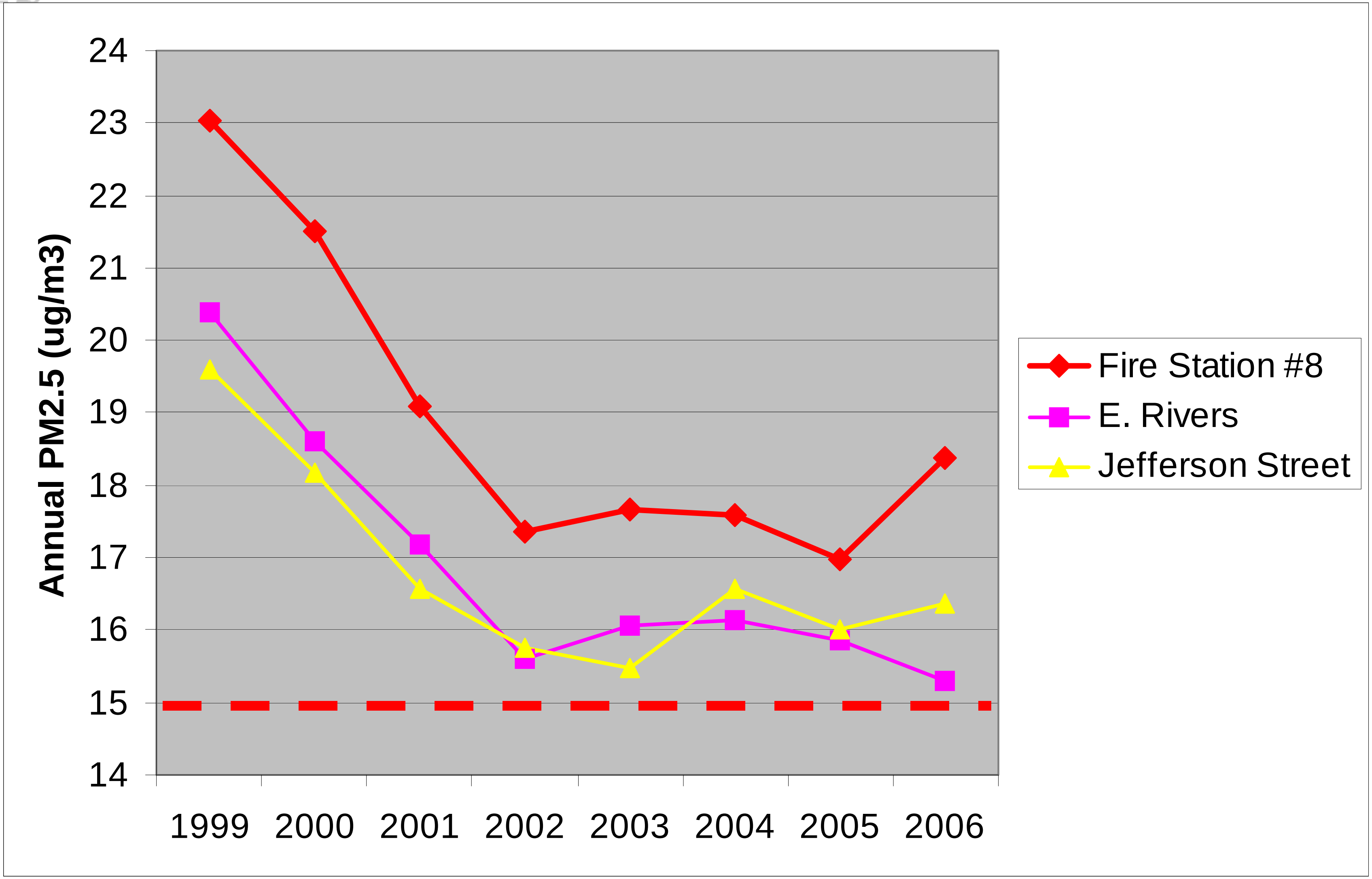
- Demonstrate attainment with annual PM2.5 NAAQS in Atlanta by 2012
  - *Model regional/urban scale sources with CMAQ*
  - *Quantify Local Increment*
  - *Identify Significant Local Emission Sources*
  - *Model local sources with AERMOD*
  - *Adjust 2012 Design Value based on local emission reductions*

Location of Core Urban Sites



Annual Average $PM_{2.5}$

(Stations <3 miles from Fire Station #8)



CMAQ PM2.5 Projections

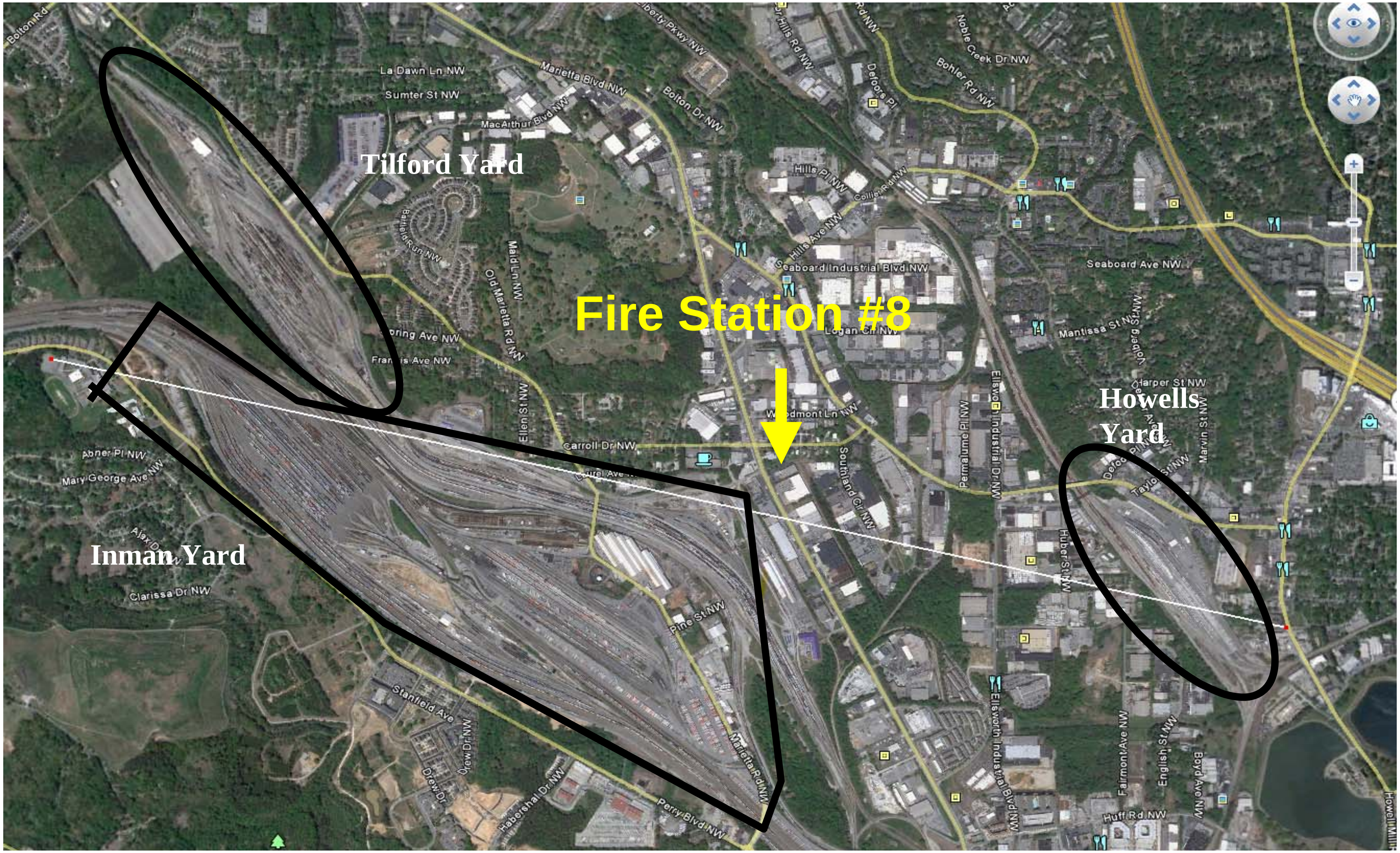
AIRS ID	County	2002 DVC	2009 DVF	2012 DVF
13-063-0091	Clayton	16.5	15.1	14.0
13-067-0003	Cobb	16.3	14.6	13.2
13-067-0004	Cobb	15.2	13.6	12.4
13-089-0002	DeKalb	15.9	14.4	13.3
13-089-2001	DeKalb	16.2	14.4	13.1
13-121-0032	Fulton	16.5	14.9	13.6
13-121-0039	Fulton*	18.3	16.6	15.4
13-135-0002	Gwinnett	16.1	14.3	13.0
13-139-0003	Hall	15.1	13.4	12.1
13-223-0003	Paulding	14.3	12.8	11.5

***Local Increment at Fire Station #8 = 1.8 $\mu g/m^3$**

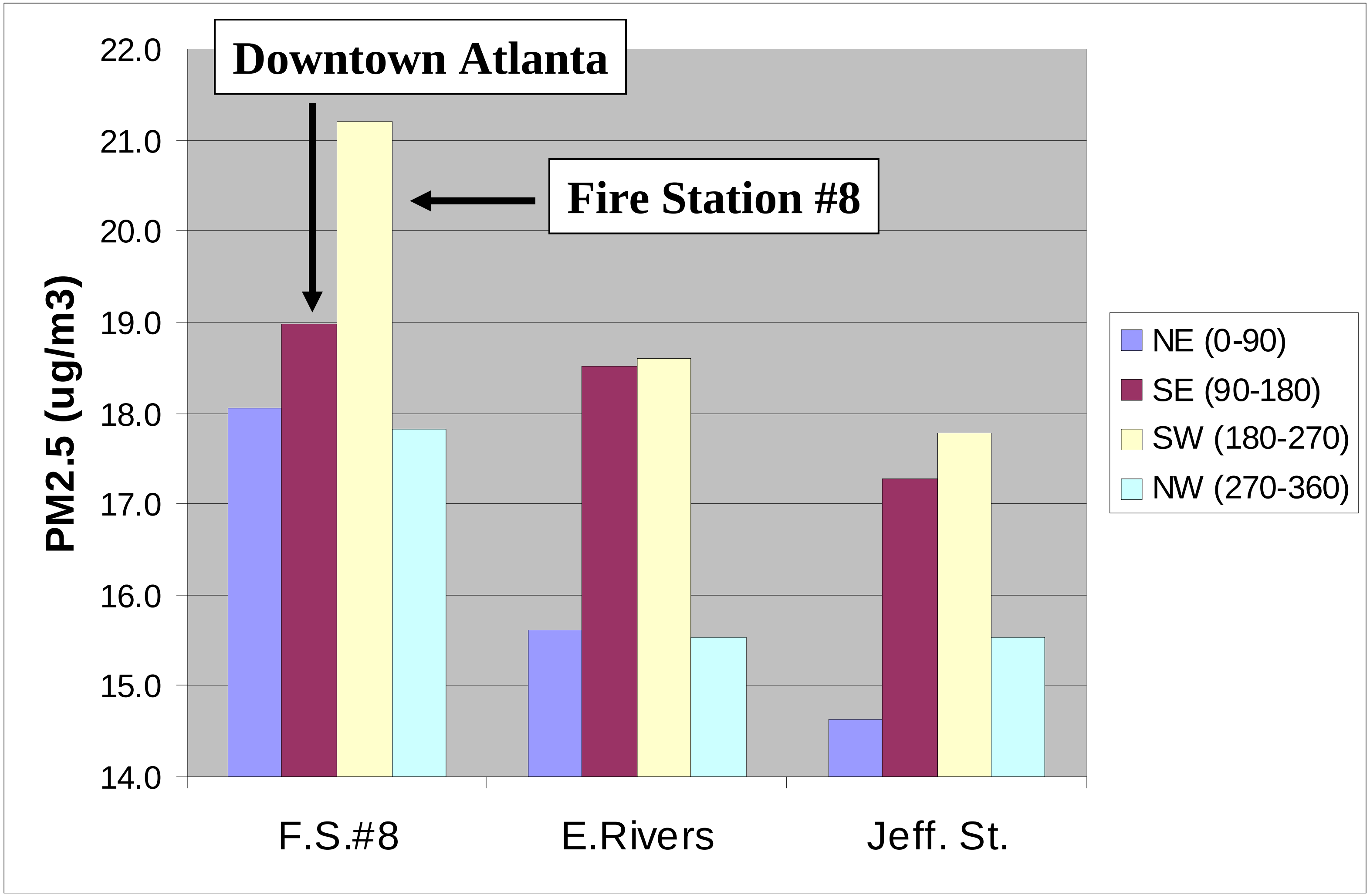
Local PM2.5 Sources

- Rail Yards
  - Inman, Tilford, and Howells
- On-Road Mobile
  - Marietta Blvd., Marietta St., and Bolton Rd.
- Local Industrial Facilities
  - Plant McDonough, others…

Railyard and Fire Station #8



PM2.5 vs. Wind Direction



Local PMF Analysis

Factor	Contribution ($\mu g/m^3$)	p-value
Soil	0.25 ± 0.17	0.138
Cement	0.21 ± 0.19	0.279
Biomass burning	0.23 ± 0.20	0.247
Secondary sulfate	0.08 ± 0.18	0.646
Steel	**1.18 ± 0.18**	**5E-08**
Zn-rich/Mobile sources	**0.60 ± 0.26**	**0.025**

2012 Emission Reductions

- Railyard
  - Currently 25 yard switchers
  - Replace all switchers with Gensets by 2012
    - 93% PM2.5 emission reduction per Genset
- Mobile
  - ARC link-based VMT data
  - 50 ~ 60% reduction

Rail Inventory

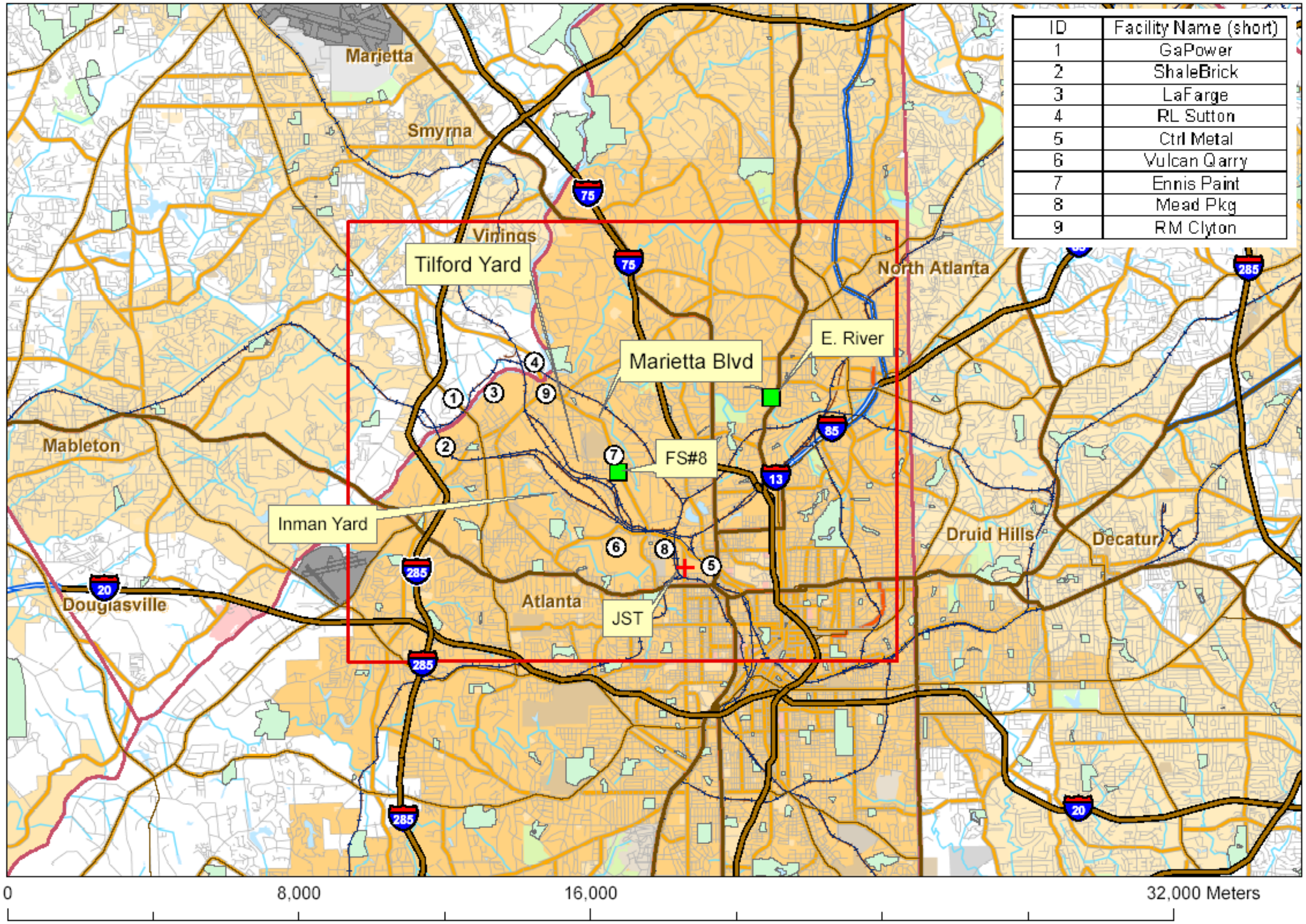
- GA EPD Approach for AERMOD (2002)
  - Contacted railyards directly
- ERTAC Approach (2007/2008)
  - Top-down, nationwide Class 1 railyard inventory

Railyard	2002 EPD (tons/yr)	ERTAC Rail (tons/yr)	2012 EPD (tons/yr)
Inman	10.54	7.20	0.74
Tilford	7.53	4.24	0.53
Howells	0.75	5.80	0.053
TOTAL	18.82	17.24	1.323

Mobile Emission

Roadway	Length (mi.)	2002 (grams/day)	2012 (grams/day)	Reduction (%)
Bolton Rd.	1.496	1814	727	60
Marietta Rd.	2.727	1032	NA	NA
Marietta Blvd.	3.712	6917	3413	51

AERMOD Modeling Domain

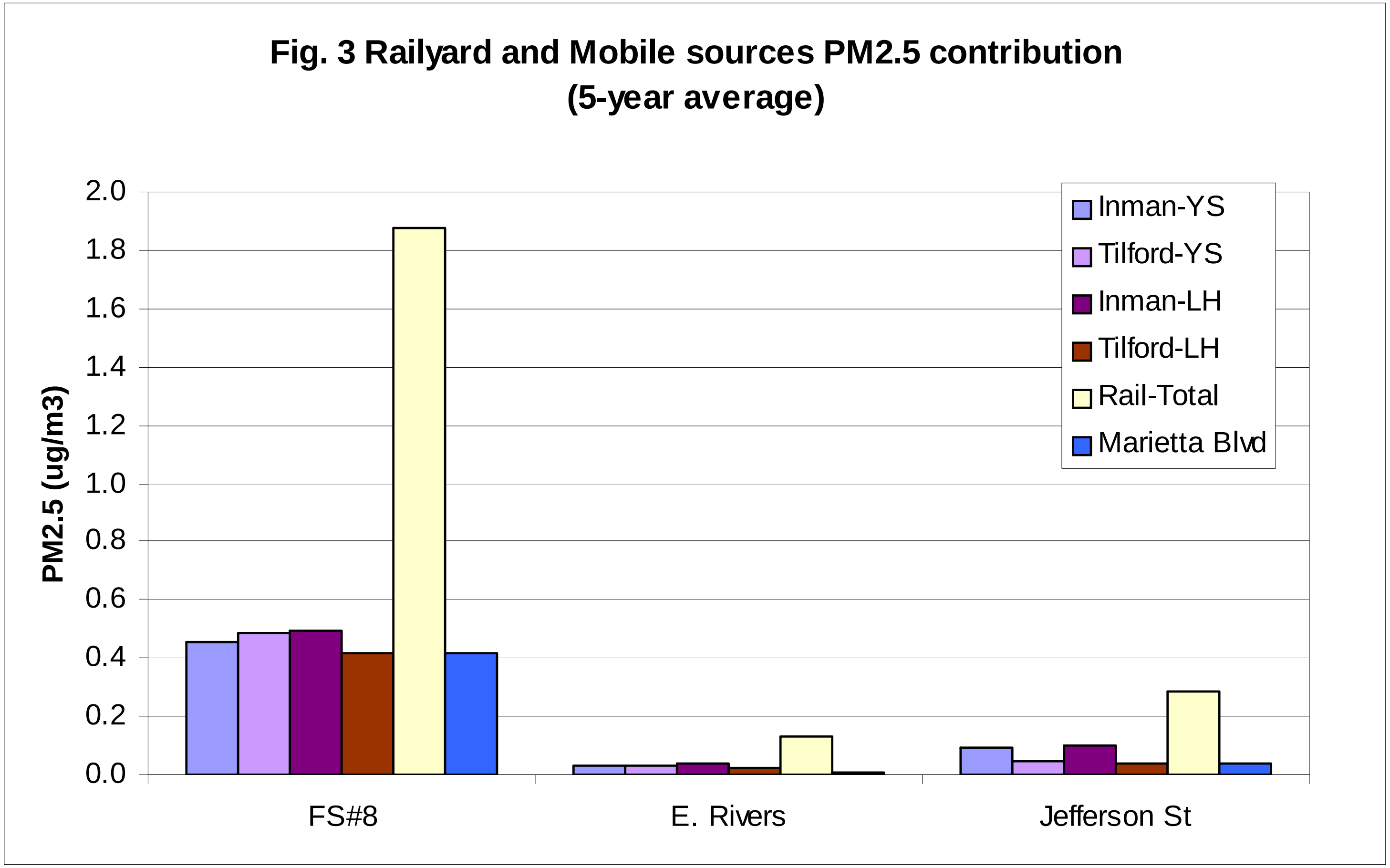


ID	Facility Name (short)
1	GaPower
2	ShaleBrick
3	LaFarge
4	RL Sutton
5	Ctrl Metal
6	Vulcan Qarry
7	Ennis Paint
8	Mead Pkg
9	RM Clyton

Local Facilities (>5 tons/year)

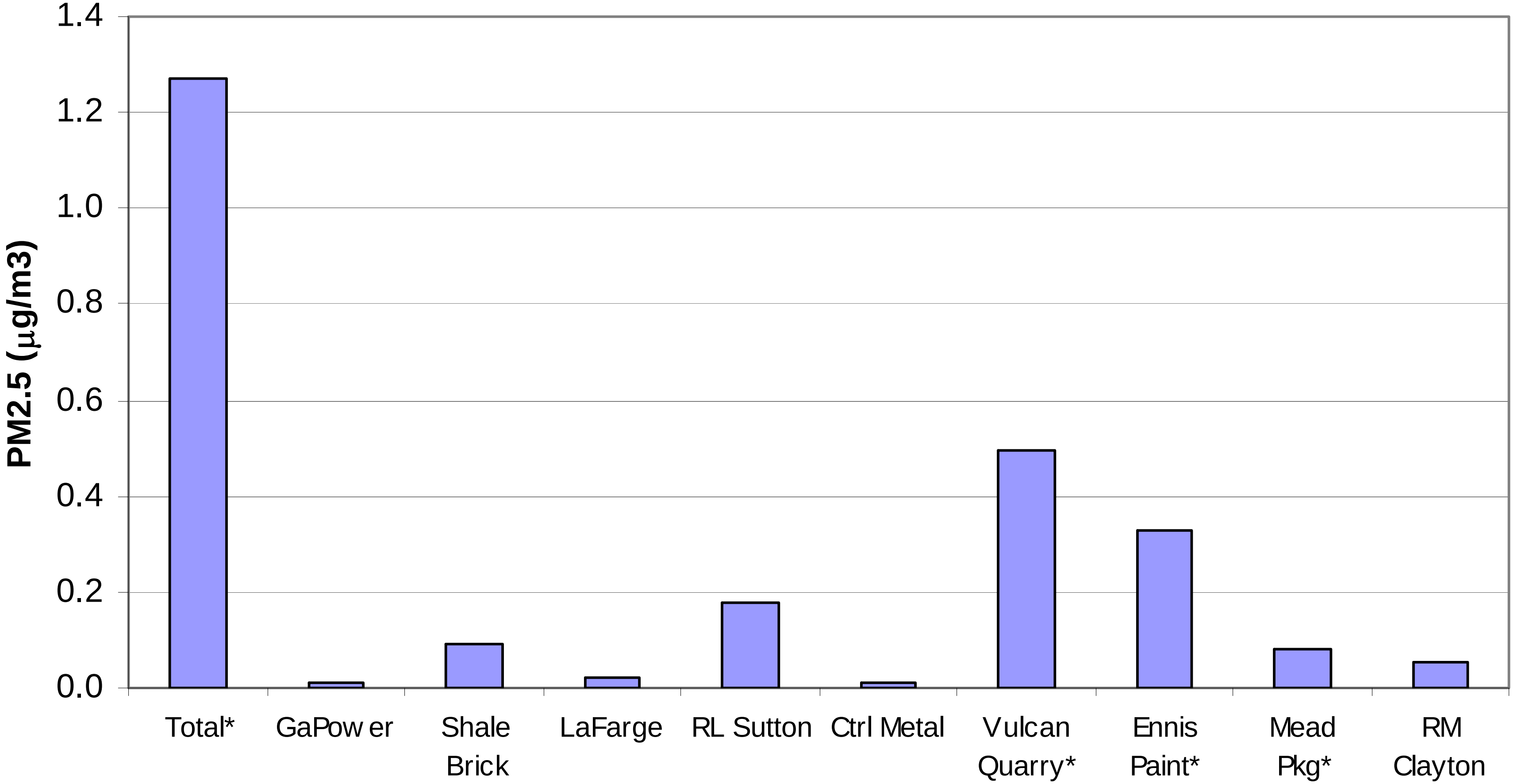
Map ID	Facility Name	2002 PM2.5 (ton/yr)	2002 PM10 (ton/yr)	2002 PM (ton/yr)	Notes
1	GA Power – Plant McDonough	**145.9**	332.5	494.6	**CERR**
2	General Shale Brick Inc Plt 30			**45.0**	**CERR**
3	LaFarge Bldg Materials, Inc	**27.5**	32.6	143.9	**Not in CERR**
4	RL Sutton WPCP			**40.40**	**Not in CERR**
5	Central Metals Co		**8.00**		**Not in CERR**
6	Vulcan Const Materials LP		**46.00**		**Not in CERR**
7	Ennis Paint, Inc			**9.61**	**Not in CERR**
8	Meadwestvaco Packaging		**10.5**		**Not in CERR**
9	Atlanta R.M. Clayton WPCP		**21.1**		**Not in CERR**

Railyard and Mobile Source Contribution* to Annual PM2.5



***Results are presented as 5-year average impact (2002 emissions).**

Local Facility Contribution* to Annual PM2.5 at FS#8



***Results are presented as 5-year average impact (2002 emissions).**

Adjustment to 2012 DVF

- Calculate quarterly local Increment
  - Modeled local increment larger than measured
- Calculate quarterly percent (%) reduction in modeled local increment due to 2012 local controls
- Multiply measured quarterly local increment by quarterly percent reduction in modeled local increment
- Adjust quarterly 2012 DVF to account for local controls
- Sum quarterly 2012 DVF for four quarters
- Compare to NAAQS to show attainment

Charge Question #1

- ***What type of air quality problems are they trying to solve with their fine-scale modeling?***
  - Objective is to demonstrate attainment with annual PM2.5 NAAQS in Atlanta by 2012.

Charge Question #2

- ***Are there analysis techniques that have been useful to help validate emission biases, identify key sources in their area, and prioritize the inventory improvement work?***
  - Key sources were identified by PMF, wind direction analysis, and an emission threshold criteria (>5 tons/year within AERMOD domain).
  - Biases in the rail emissions were examined by comparing GA EPD rail inventory to ERTAC rail inventory.
  - Modeled impacts from emission biases were minimized by using relative (% change) model results instead of absolute model results (change in $\mu g/m^3$).

Charge Question #3

- ***Which source categories did they improve and what methods did they use?***
  - Railyard, mobile sources, point sources.
  - Detailed methods contained in Appendix M.

Charge Question #4

- ***What kind of before/ after differences in emission estimates and modeling results are they seeing?***
  - Developed high quality rail yard emission inventory.
  - Added new emission estimates for point sources that were never quantified before.

Charge Question #5

- ***Is there NEI analysis that would be particularly helpful to their efforts? At what step in their process?***
  - Add additional small point sources to NEI.
  - Add mobile sources by road link instead of by county total.
  - Add temporal profiles to account for hourly, day-of-week, and monthly variability in emissions.

Contact Information

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Granite City, IL $PM_{2.5}$ Nonattainment: Regional and Local-Scale Modeling, Data Analysis, and Emissions Control Developments

Jeffrey Sprague, Illinois EPA (Bureau of Air)

State/Local Focus Group: Emission Inventories for Fine Scale Modeling

July 27, 2010

Specific Objective:

Demonstrate Attainment with Annual $PM_{2.5}$ NAAQS in Granite City, IL by 2009/2012

---Urban/Regional Scale Modeling (CMAQ)

---Identify Likely Sources Causing Local Nonattainment

---Perform 2002, 2012 Hybrid Modeling (CAMx, AERMOD) & Implement Speciated Modeled Attainment Test (SMAT): obtain seasonal/annual average concentrations, relative reduction factors (RRFs), and culpability

---Adjust "Process", Impose/Negotiate Reductions to meet the NAAQS

St. Louis $PM_{2.5}$ Nonattainment Area & Monitoring Network

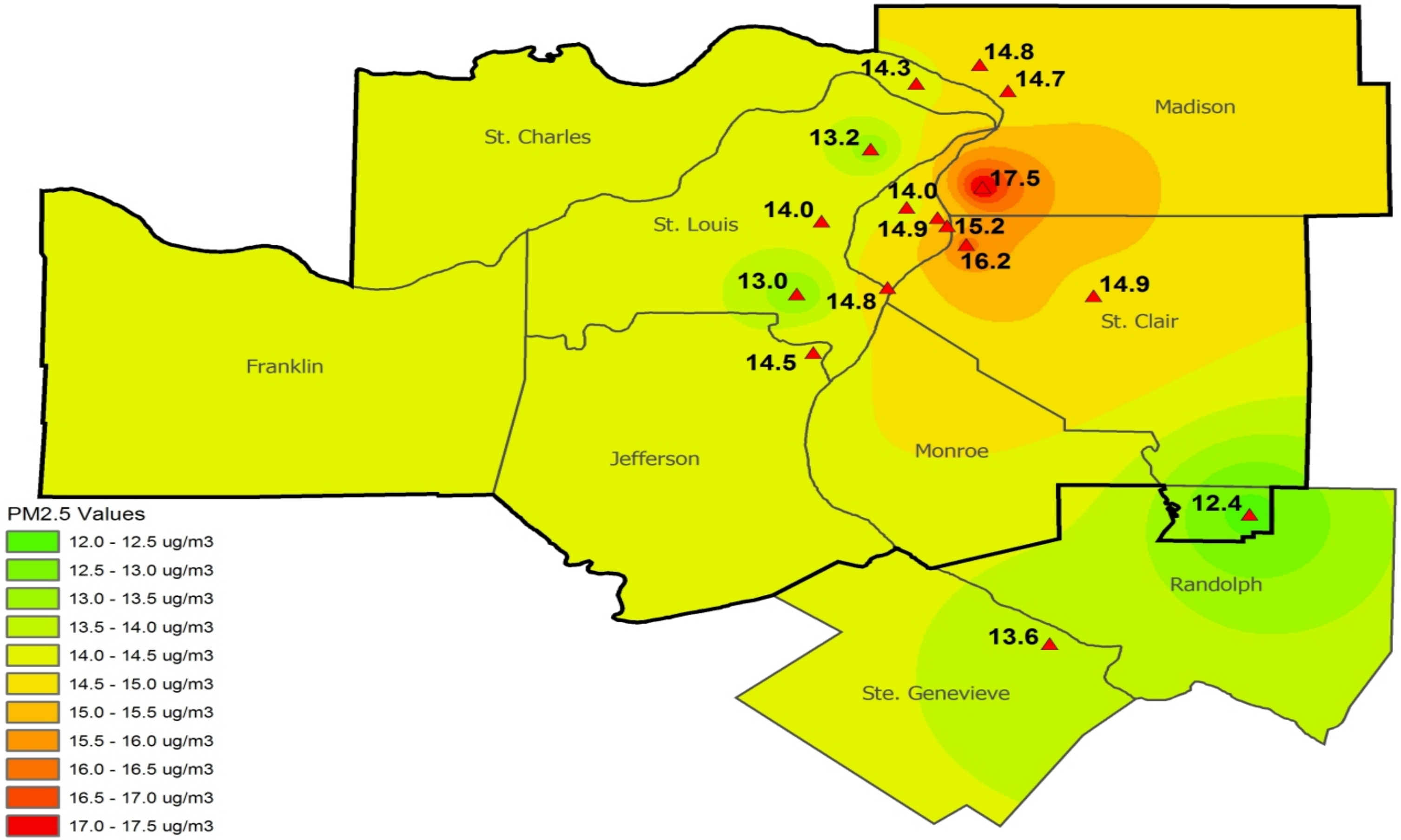
$PM_{2.5}$ Annual Average Concentrations & Three Year Design Values

Monitor Site	$PM_{2.5}$ Annual Concentrations ($\mu g/m^3$)								$PM_{2.5}$ Annual Design Values ($\mu g/m^3$)					
<u>Missouri</u>	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**02-04**	**03-05**	**04-06**	**05-07**	**06-08**	**07-09**
West Alton	14.2	14.0	11.9	15.2	11.6	13.2	Disc	Disc	13.4	13.7	12.9	13.3	Disc	Disc
Margaretta	14.3	13.5	12.1	15.3	12.8	Disc	Disc	Disc	13.3	13.6	13.4	Disc	Disc	Disc
Blair Street	15.4	14.1	13.2	16.1	13.4	13.9	12.9	11.5	14.2	14.5	14.2	14.5	13.4	12.8
South Broadway	15.3	14.4	13.1	15.9	13.1	14.0	12.5	11.9	14.3	14.5	14.0	14.3	13.2	12.8
Mound Street	15.6	14.7	13.6	15.9	13.7	14.3	12.7	11.5	14.6	14.7	14.4	14.6	13.6	12.8
Branch							13.4	12.0					**	**
Oakville							13.4	11.7					**	**
Clayton	14.6	13.6	12.2	15.5	11.8	13.1	12.0	11.3	13.5	13.8	13.2	13.5	12.3	12.1
Sunset Hills	13.0	13.0	11.6	14.6					12.5	13.1				
Arnold*	15.0	14.0	12.6	15.4	12.6	13.7	11.6	9.0	13.9	14.0	13.5	13.9	12.6	11.4
<u>Illinois</u>														
Granite City	17.7	17.5	15.4	18.2	16.3	15.1	15.7	11.3	16.9	17.0	16.6	16.5	15.7	14.0
Alton	14.7	14.0	11.5	16.0	13.1	14.9	12.5	10.2	13.4	13.8	13.5	14.7	13.5	12.5
Wood River	15.1	14.0	13.2	16.0	13.1	14.2	12.2	11.0	14.1	14.4	14.1	14.4	13.2	12.5
E. St. Louis	16.6	14.8	14.7	17.1	14.5	15.6	12.6	11.7	15.4	15.5	15.4	15.7	14.2	13.3
Swansea	15.1	14.3	13.2	16.0	13.4	13.3	12.6	11.7	14.2	14.5	14.2	14.2	13.1	12.5
Houston	11.6	13.4	10.9	15.2	11.4	14.2	10.4	9.7	12.0	13.2	12.5	13.6	12.0	11.4

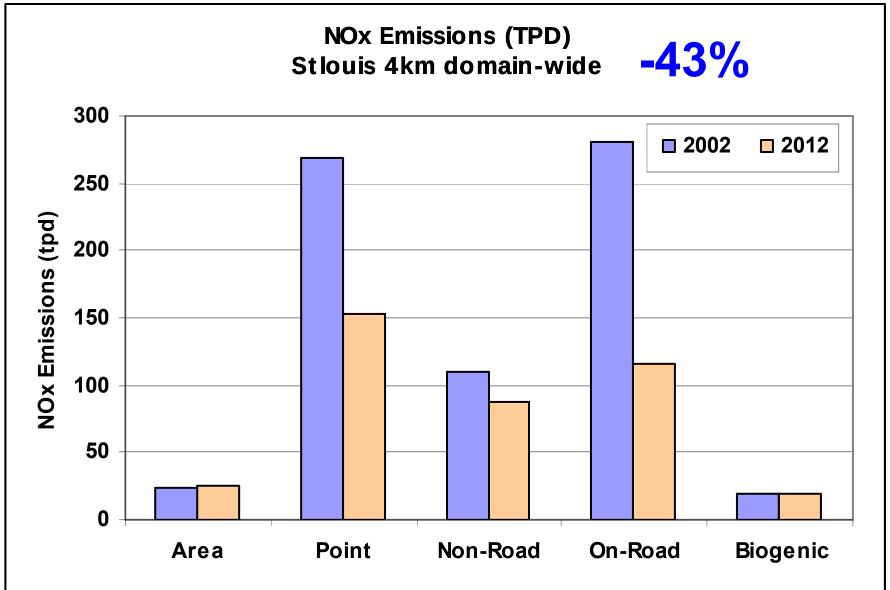
*-combination of Arnold and Arnold West sites

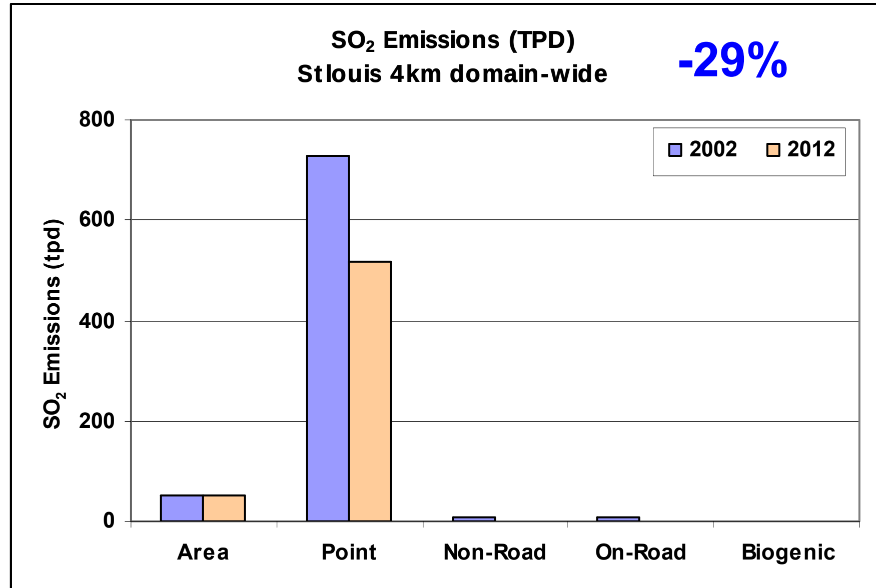
**-design value cannot be calculated until three years data are available

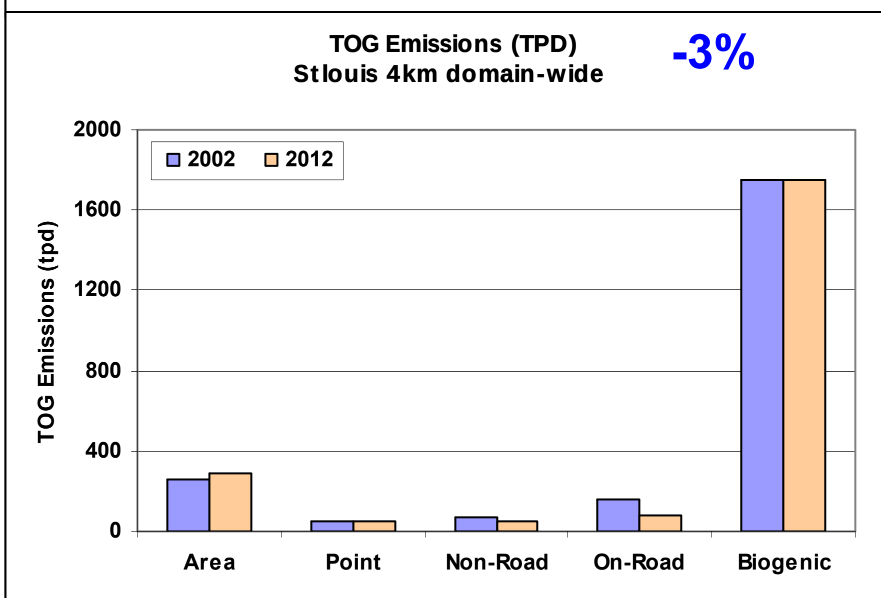
St. Louis Region
2001-2003 Annual PM2.5 Design Values

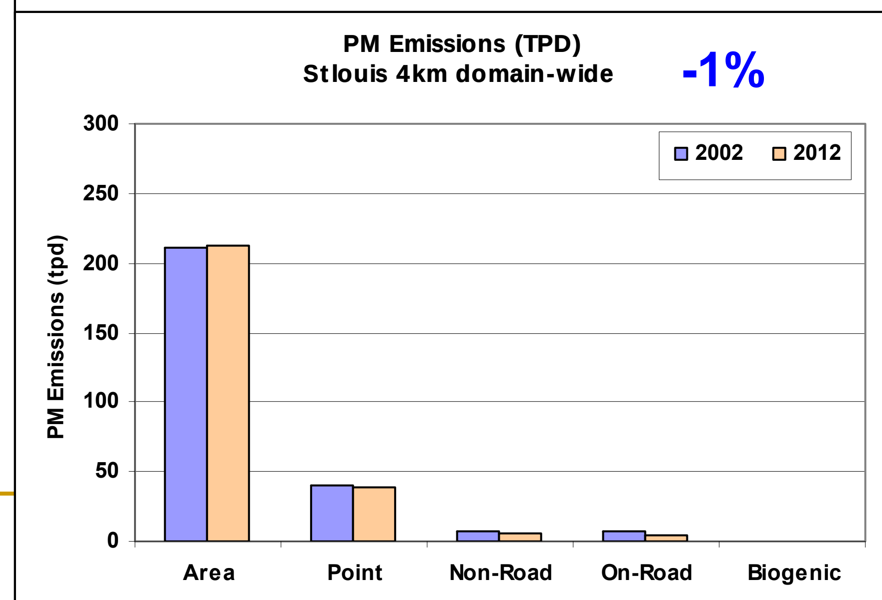


Emission Summaries (approximate NAA)

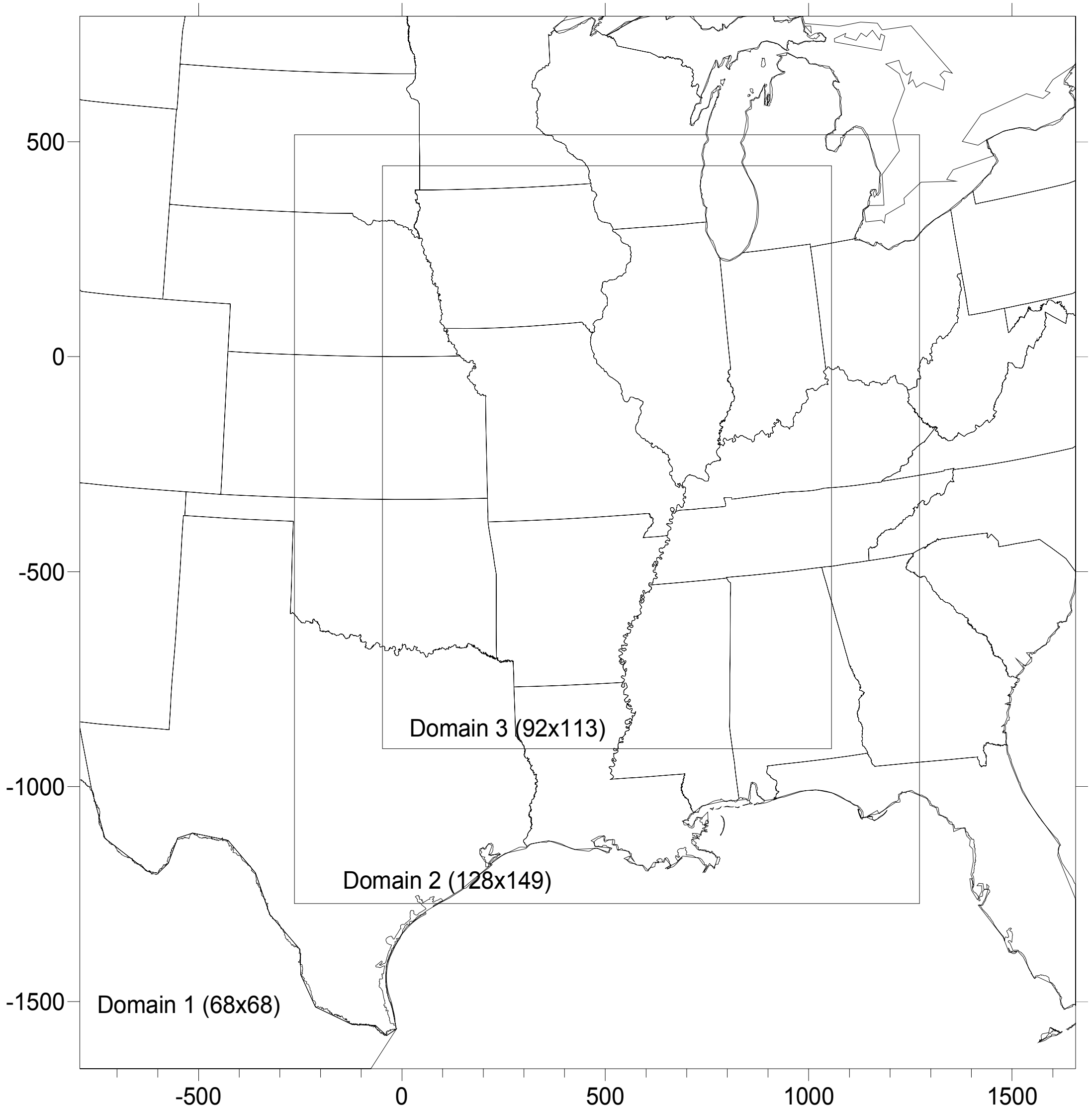








MDNR 36/12 km Regional Modeling



2002 Annual Period

36/12 km MM5, SMOKE, CMAQ and CAMx modeling

BCs from VISTAS/ASIP 2002, 2009 and 2012 CMAQ simulations

Model Evaluation on regional (12 km) and local (urban STN, FRM, StL-SS sites) scales

Map graphic and text provided by Ralph Morris (ENVIRON International Corporation)

Annual $PM_{2.5}$ CMAQ Modeling: Future Year Results

Baseyear (2002) Monitored Design Value is **<u>17.5 ug/m³</u>**.

Projected (2009, 2012) Granite City FRM annual $PM_{2.5}$ design values exceeded NAAQS.

Projected 2012 design value for the Granite City monitor is **<u>15.23 ug/m³</u>**. All other monitors demonstrate attainment.

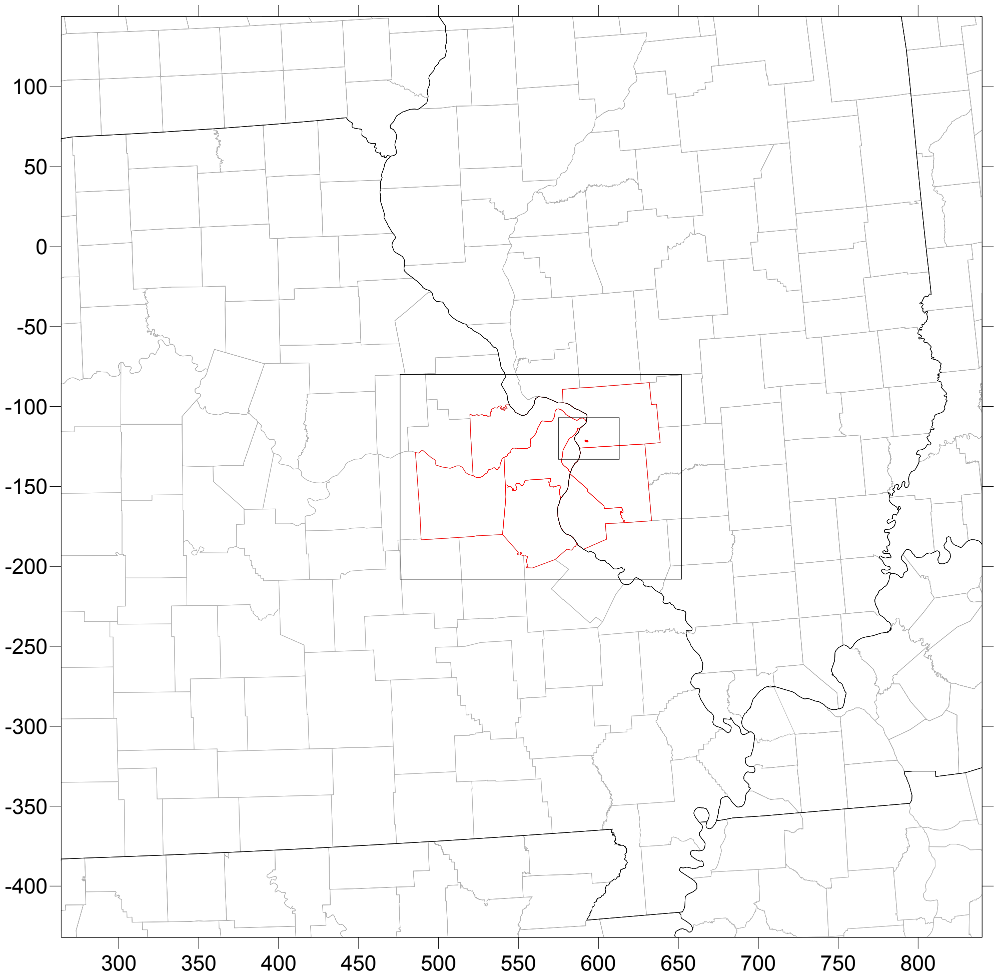
2012 "zero-out" sensitivity test of U.S.Steel: projected design value for Granite City FRM is **<u>13.55 ug/m³</u>** (Same emissions as previous, except zero emissions for USS. Results indicate USS primarily responsible for <u>excess emissions</u> after accounting for regional/local controls.)

Local Area Analysis

Regional modeling (36/12 km) did not fully "capture" Metro-East $PM_{2.5}$ concentrations (local source contributions). So, implementing "Local Area Analysis" with high-resolution, hybrid photochemical grid/plume modeling system:

CAMx 12/4/1 km modeling using Plume-in-grid (PiG) and PM Source Apportionment Technology (PSAT) with plume model (AERMOD) for local sources.

IEPA CAMx Local-Scale Modeling



2002 Annual Period

12/4/1 km Nested-Grids

BCs from MDNR 36/12 km

Identify Local sources and model with Plume-in-Grid:

- US Steel Granite City Works
- American Steel Foundries – Keystone
- Gateway Energy and Coke Company

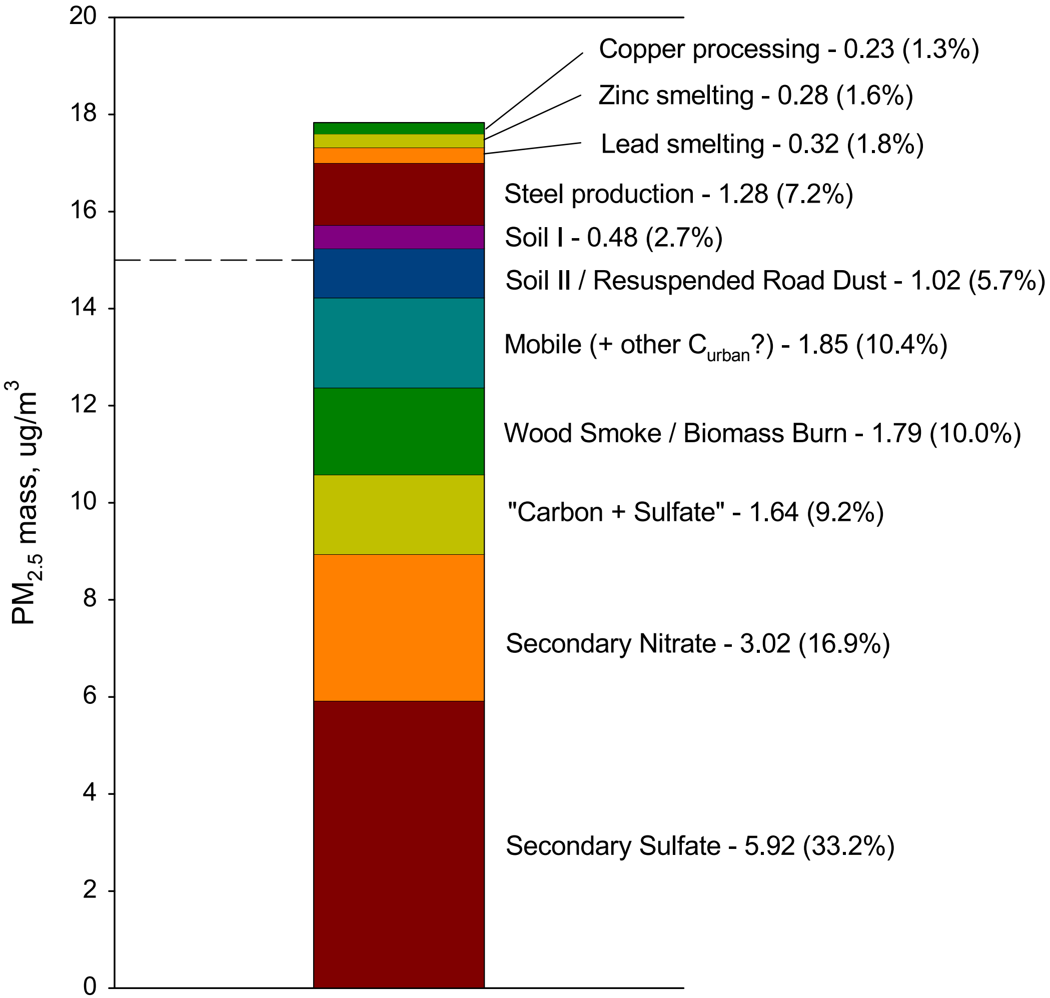
4/1 km meteorology from 12 km MM5 (flexi-nest)

4 km emissions modeled with SMOKE (MDNR)

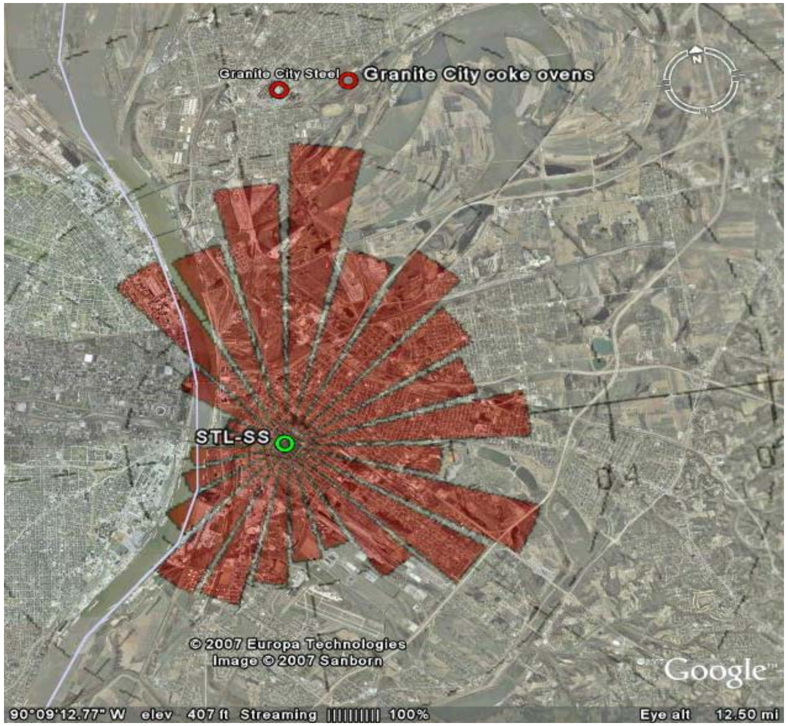
2002 Base Case and MPE

2012 (USS, ASF-K, GECC)

Receptor Modeling - St. Louis Supersite Data



PMF Factor Analysis in combination with wind direction data shows large contribution from direction of U.S.Steel – GCW.



(Slide slightly modified from Morris et.al (ENVIRON Intl. Corp.) and Turner et. al (Washington Univ.) presentation prepared for IEPA December 4, 2007)

Local Source Emissions

- Steel Foundry
- Integrated Iron/Steel Manufacturing Facility w/ By-Product Recovery Coke Batteries
- Heat Recovery Coking Plant (*permitted 2008*)

Summary of Direct PM2.5 Estimated Emissions for 2002 and 2012

Facility	Base Year (2002) (tons/day)	Base Year (2002) (tons/year)	Future Year (2012) (tons/day)	Future Year (2012) (tons/year)
USS-GCW	4.57	1651	4.65	1678
Gateway Energy & Coke	-----	-----	1.17	244
AMSTED Rail Co. Inc.	0.26	66	0.26	66
Total Emissions	4.83	1717	6.08	1988

Facilities and Receptors (AERMOD)

Baseline (2002) vs. Future year (2012): What's Different?

--2012 Production Levels assumed equal to 15 year high (coal usage +37%; coke production +40%; iron & steel production +3% and +5%, respectively)

--Planned permanent shutdown of Galvanizing Line #6, Boilers 1-10, and #4 NG-fired COG booster pump.

--Fuel type usage changes

--Current/planned construction of blending station, COG desulfurization system, BFG-fired cogeneration boiler and ancillary emission sources.

--Anticipated adoption of rulemaking emission limits (since changed to Memorandum of Understanding)

Annual Average Modeled Concentration (2012) and Principal Source Culpability ---FRM Monitor Location

Contribution from all sources: 3.95 ug/m3

U.S. Steel – Granite City Works				
Basic Oxygen Furnace (BOF)		Blast Furnace Casthouse	Coke Battery Fugitives	Other
Roof Monitor Fugitives	Vessels - ESP			
1.33 ug/m3	0.35 ug/m3	0.33 ug/m3	0.23 ug/m3	1.21 ug/m3

GECC	ASF-Keystone
0.3 ug/m3	0.2 ug/m3

Annual Average (2012) Source Culpability at FRM Monitor Location

[Total contribution from all modeled sources (USS, ASF-K, GECC): 3.95 μg/m^3]

BOF Roof Monitor Fugitives	1.339 μg/m^3 (39%)
BOF -- ESP	0.350 μg/m^3 (10%)
BOF -- Other	0.209 μg/m^3 (6%)
Blast Furnaces, Casthouse --Other	0.348 μg/m^3 (10%)
Blast Furnace Casthouse Fugitives	0.115 μg/m^3 (3%)
Coke Batteries, Quench Tower	0.299 μg/m^3 (9%)
Continuous Casters	0.191 μg/m^3 (6%)
Boilers	0.167 μg/m^3 (5%)
Slab Reheat Furnaces	0.164 μg/m^3 (5%)
COG Desulfurization	0.093 μg/m^3 (3%)
Galvanizing Lines #7, #8	0.089 μg/m^3 (2%)
Pellet Scrng, Coal Hndlg, Rds, Stkpiles, Pcklng, etc.	0.085 μg/m^3 (2%)

GECC 0.3 μg/m3
ASF-K 0.2 μg/m3

Calculated Relative Response Factors

AERMOD-Based Relative Response Factors

Base Year (2002) to Projected Year (2012)---Total Direct PM2.5 Mass

UTM: x(m), y(m)		Quarter1	Quarter2	Quarter3	Quarter4	Annual Avg
748845.0	**4287661.0**	**1.168**	**1.186**	**1.168**	**1.131**	**1.163**

AERMOD-Derived Relative Response Factors

- Base Year FRM Receptor Concentration = 3.39 ug/m^3
- Projected (2012) FRM Receptor Concentration = 3.95 ug/m^3
- Relative Response Factor = FYRC/BYRC = 1.16

(*FYRC= future year receptor concentration*)

(*BYRC = base year receptor concentration*)

- Project 2012 Design Value through application of:

DVF = DVC X RRF

(*DVF = future design value; DVC = current design value;*
RRF = relative response factor)

Modeled Attainment Test

Project 2012 $PM_{2.5}$ design value through separate projections of regional and local components and using modeling results in a "relative" sense:

1.) DVF = DVC X RRF

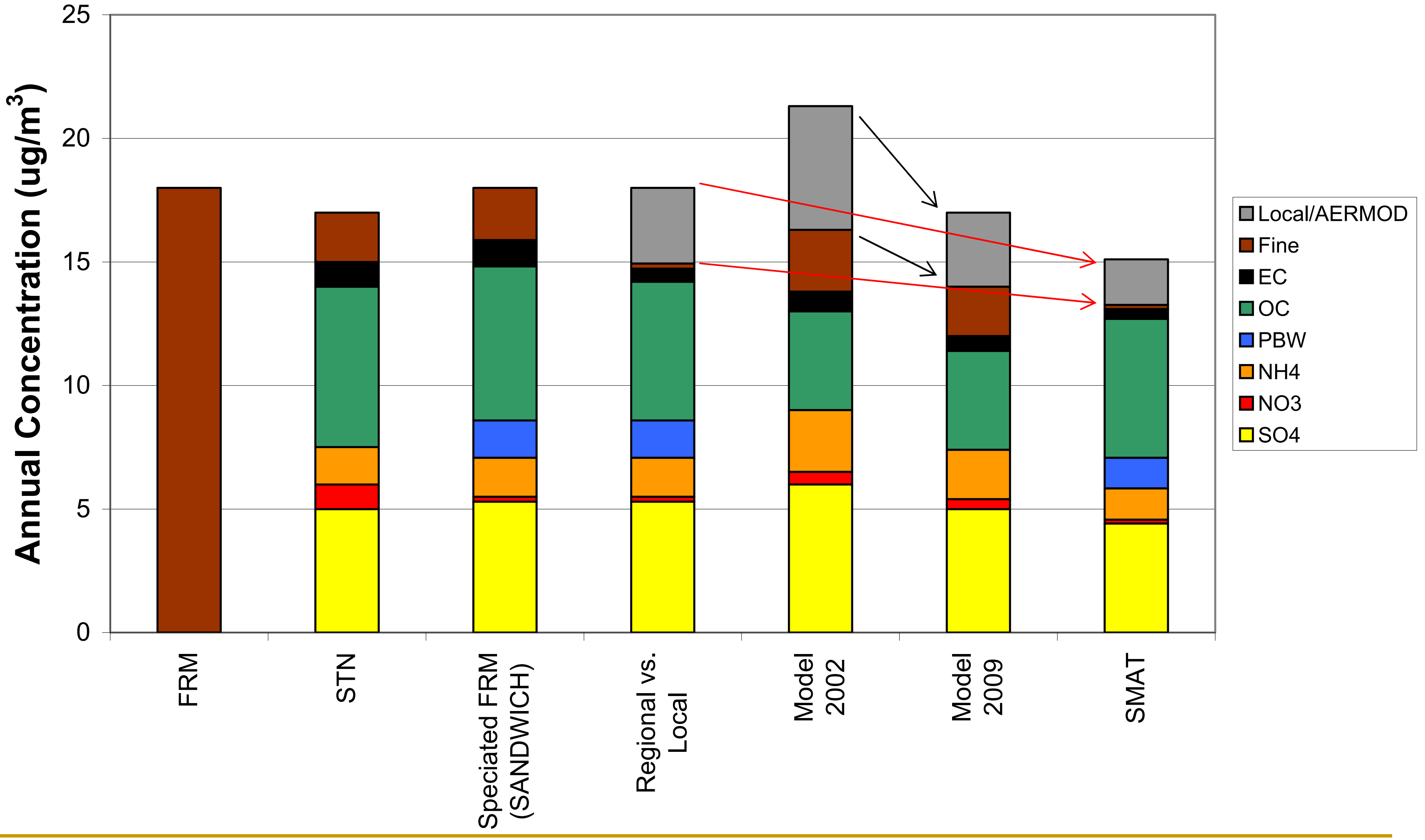
2.) Current Design Value (DVC) is separated into local and regional components: DVC_{local} + $DVC_{regional}$ = DVC

3.) Project DVC_{local} to DVF_{local} using local source changes---implemented using AERMOD modeling results

4.) Project $DVC_{regional}$ to $DVF_{regional}$ using regional concentration changes without local contributions---implemented with CAMx PSAT modeling results and the Speciated Modeled Attainment Test (SMAT)

5.) Combine DVF_{local} and $DVF_{regional}$ to get DVF (Future Design Value)

Example: Regional/Local Projection



"First Cut" Hybrid Projection Speciated Modeled Attainment Test

	2002 Design Value	2012 Design Value	% Change
"Bottom Line"→	17.27 ug/m^3	16.92 ug/m^3	- 2.0
Local	3.2 ug/m^3	3.68 ug/m^3	+ 15
Regional	13.57 ug/m^3	12.73 ug/m^3	- 6.2
Blank Correction	0.5 ug/m^3	0.5 ug/m^3	0.0
Crustal (regional)	0.73 ug/m^3	0.87 ug/m^3	+ 20
EC (regional)	0.52 ug/m^3	0.37 ug/m^3	- 28
OCM (regional)	6.19 ug/m^3	6.46 ug/m^3	+ 4
SO4 (regional)	3.10 ug/m^3	2.45 ug/m^3	- 21
NO3 (regional)	0.84 ug/m^3	0.71 ug/m^3	- 15
NH4 (regional)	1.22 ug/m^3	1.10 ug/m^3	- 10
PBW (regional)	0.99 ug/m^3	0.77 ug/m^3	- 22

Results provided by Mr. Ralph Morris (ENVIRON International Corporation, Novata, California) on February 23, 2009

"First Cut" Hybrid Projection SMAT Assumptions and Data Options

- Used the average of three $PM_{2.5}$ Design Values from 2000-2004 for the starting design value concentration.
- Used the East St. Louis Super Site speciation data in SANDWICH (Gateway Medical Center CSN data was not yet available).
- Assumed a 3.2 ug/m^3 local source contribution based upon the work of Turner and Garlock. Of this local contribution, assumed 3.0 ug/m^3 crustal and 0.2 ug/m^3 OCM.

Proposed U.S. Steel BOF Rulemaking

- IEPA produced internal draft rule to require MACT standards for <u>new</u> BOF sources under final NESHAP (Integrated Iron & Steel Manufacturing Facilities – 2003, amended 2006) be applicable to the <u>existing</u> USS-GCW BOF Shop.
- On/after January 1, 2012:

--All BOF PM emiss's ducted to control equip.

--Uncaptured emissions from any BOF shop opening must not exceed 10% opacity.

Proposed U.S. Steel BOF Rulemaking (cont.)

--PM emiss's from control equipment:

*<=0.01 gr/dscf (in operation before 1/1/2010)

*<=0.0052 gr/dscf (start-up after 1/1/2010)

*Average opacity <=10%

--Hot metal transfer, desulfurization, skimming, and ladle lancing PM emiss's <=0.003 gr/dscf

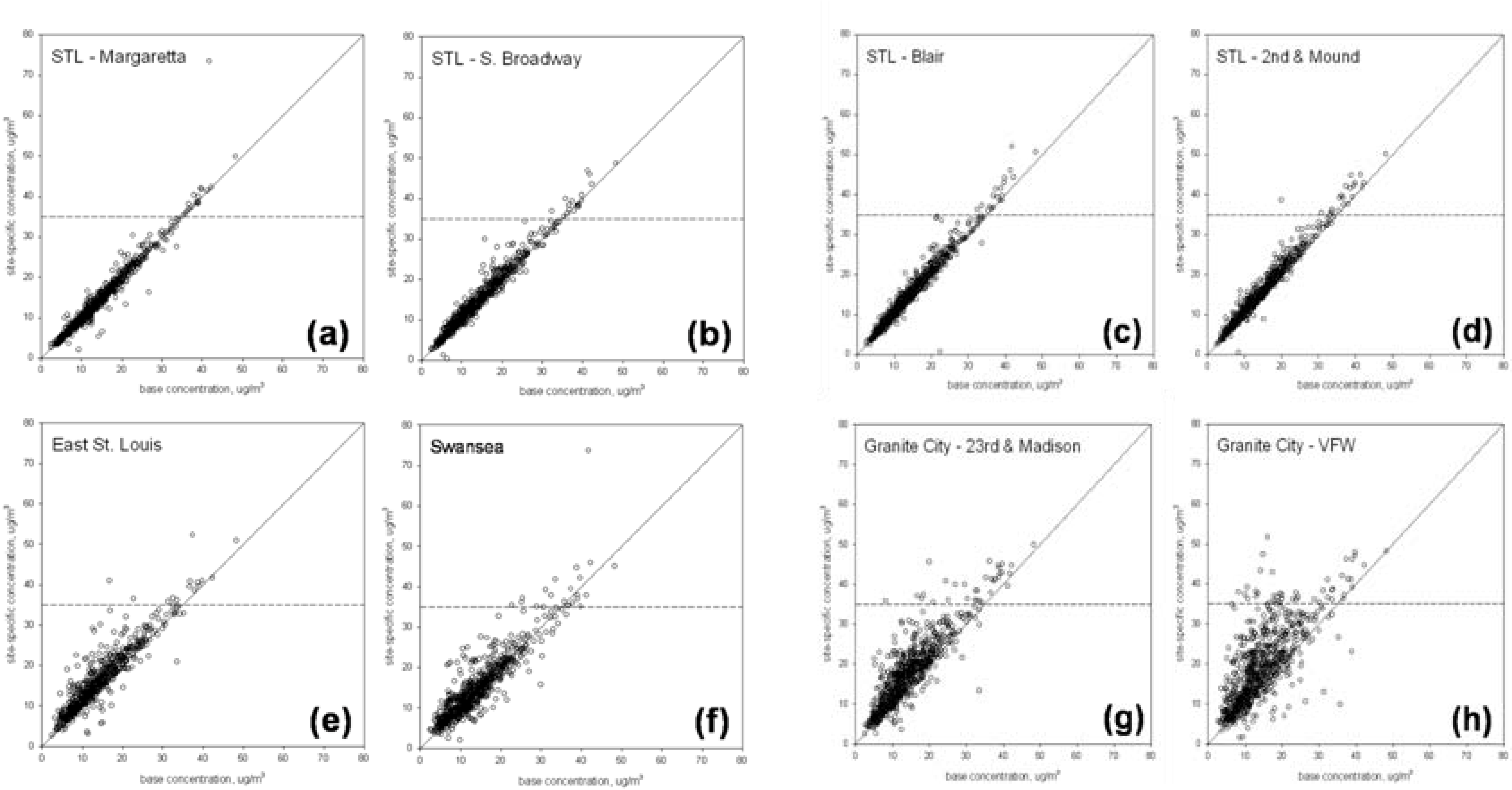
--Ladle metallurgy PM emiss's <=0.004 gr/dscf

--Equip. inspections, monitoring systems, opacity observations, recordkeeping, reporting, etc.

Technical Support Development: Monitoring Data Analysis

- Excess Mass
- $PM_{2.5}$ Chemical Speciation Data
- Temporary Idling of the U.S. Steel – Granite City Works

Daily Average $PM_{2.5}$ Mass Concentration vs. Area Wide Base Concentration



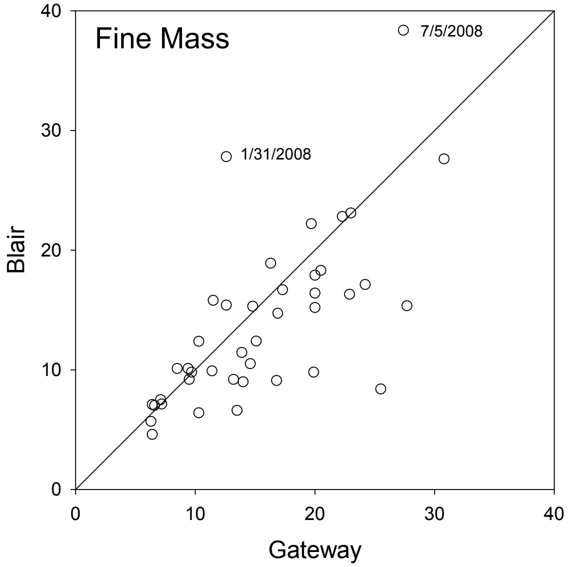
Daily-average $PM_{2.5}$ mass concentration versus the area-wide base concentration at eight compliance monitoring stations in the St. Louis area: Missouri sites (top row) and Illinois sites (bottom row) ["Local Emission Source Contributions to Ambient Fine Particulate Matter in Granite City, Illinois", draft – February 28, 2010, Jay R. Turner, Washington University in St.Louis]

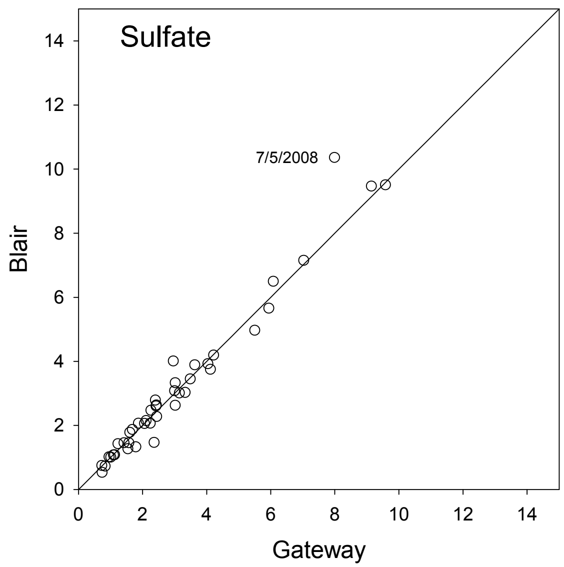
Conditional Probability Function Plot – Excess $PM_{2.5}$

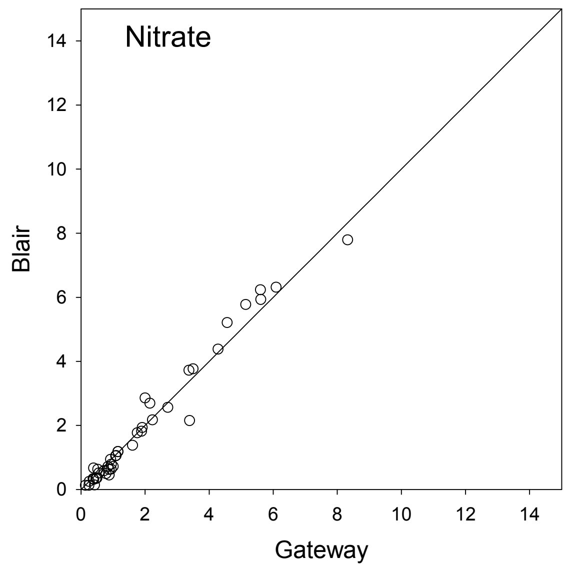
An analysis of local versus regional $PM_{2.5}$ concentrations at the Granite City FRM: $PM_{2.5}$ excess mean = 3.2 ug/m^3; median = 2.2 ug/m^3

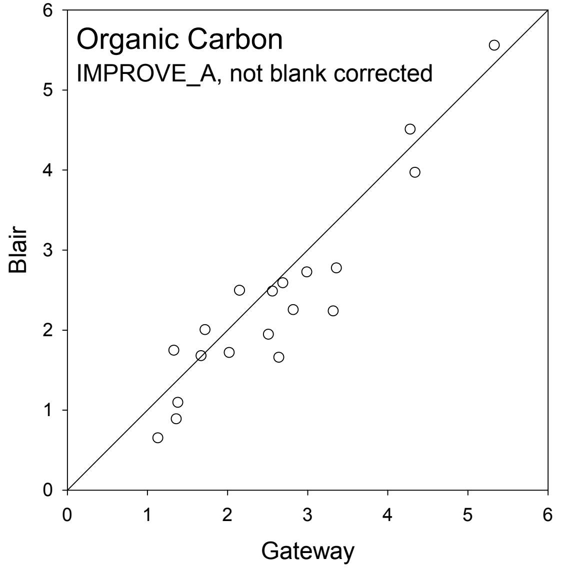
A= VFW Monitoring Site, B= 23rd & Madison Monitoring Site (Slide slightly modified from Morris et. al (ENVIRON Intl. Corp.) and Turner et. al. (Washington Univ.) presentation prepared for IEPA December 4, 2007)

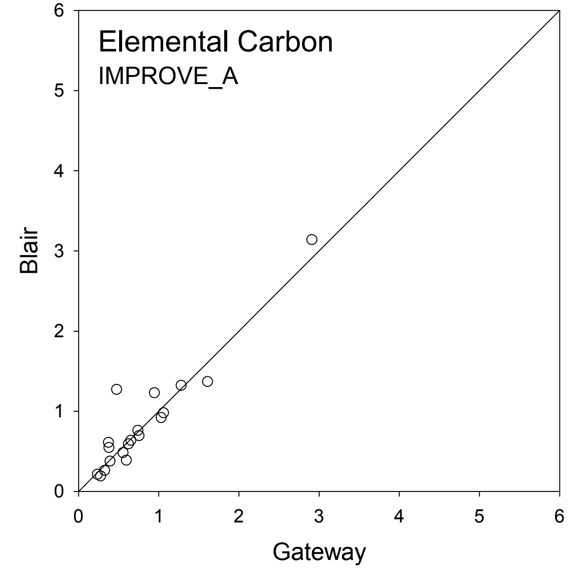
CSN data, Blair versus Gateway Medical Center, October 2007 – July 2008, max N = 40
All concentrations are μg/m³ (*Jay Turner, Washington University in St. Louis, December 1, 2008*)

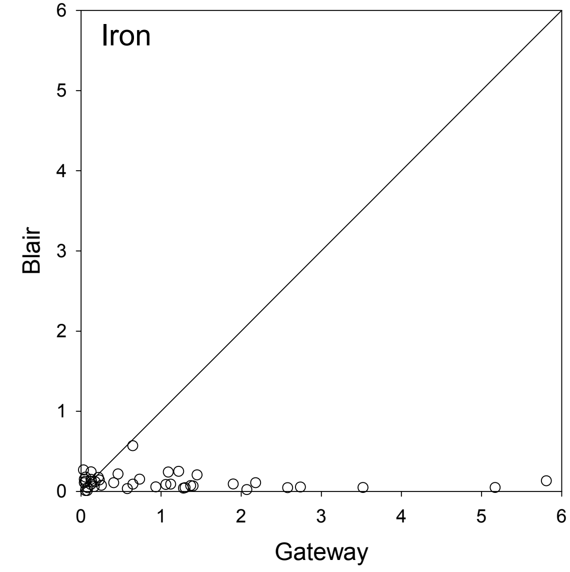


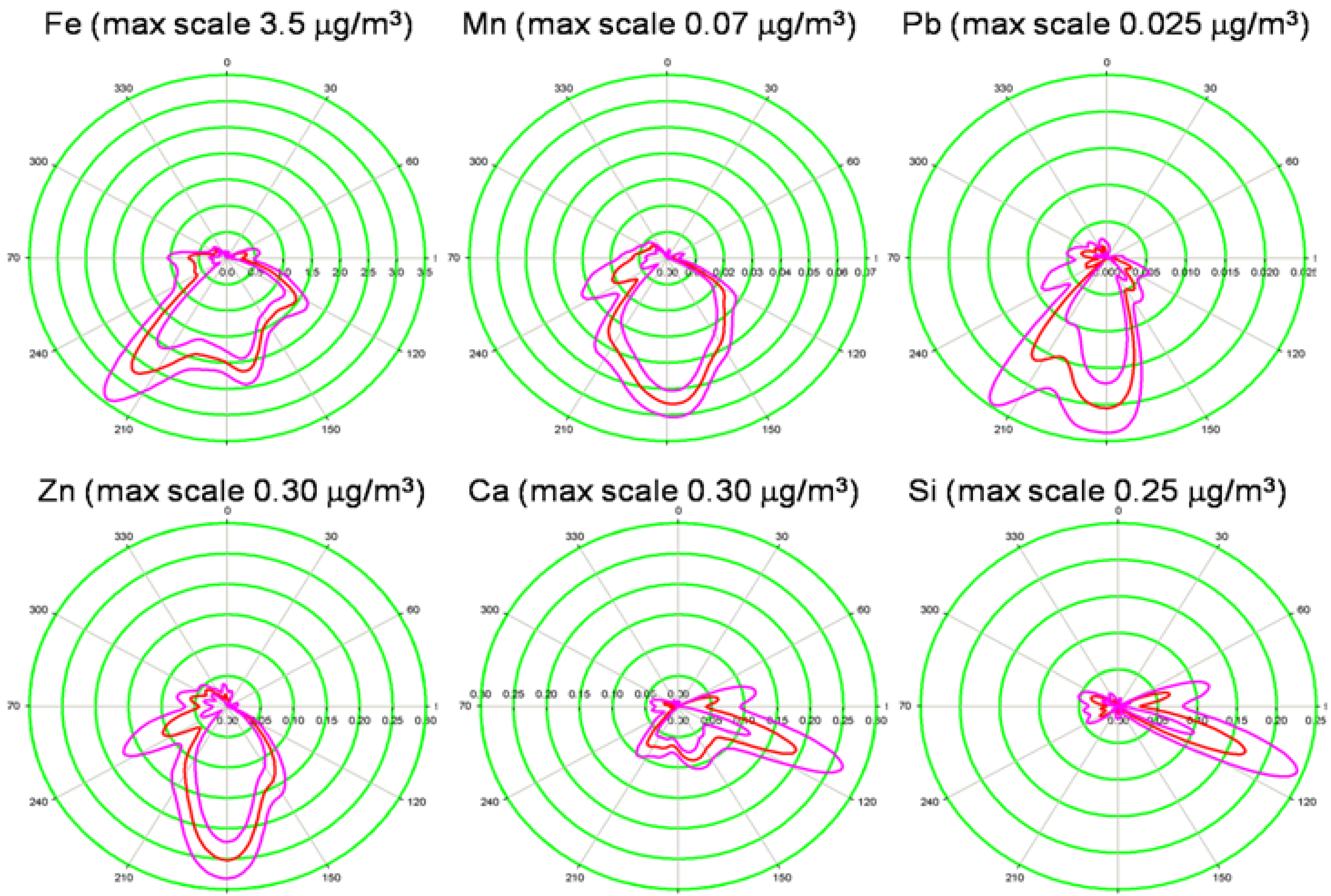












Pollution roses for PM2.5 species concentration differences between the Gateway Medical Center station (Granite City) and the Blair Street station (City of St. Louis). Pollution roses generated using 1-D nonparametric wind regression with hourly surface winds from Edwardsville, IL [Jay R. Turner, Washington University in St. Louis]

Pollution rose generated by 1-D nonparametric wind regression for the PM2.5 zinc mass concentration at the Gateway Medical Center (Granite City) for the period October 2007 – October 2008. Squares denote the following operations at the Granite City Steelworks (GCSW): BF = blast furnaces; BOF = basic oxygen furnace; CC = continuous casters; CO = coke ovens [“Local Emission Source Contributions to Ambient Fine Particulate Matter in Granite City, Illinois”, draft – February 28, 2010, Jay R. Turner, Washington University in St. Louis]

Temporary Idling of USS – GCW and Modulation of $PM_{2.5}$ Mass/Species

- Slack customer demand resulted in production slowdown/stoppage:

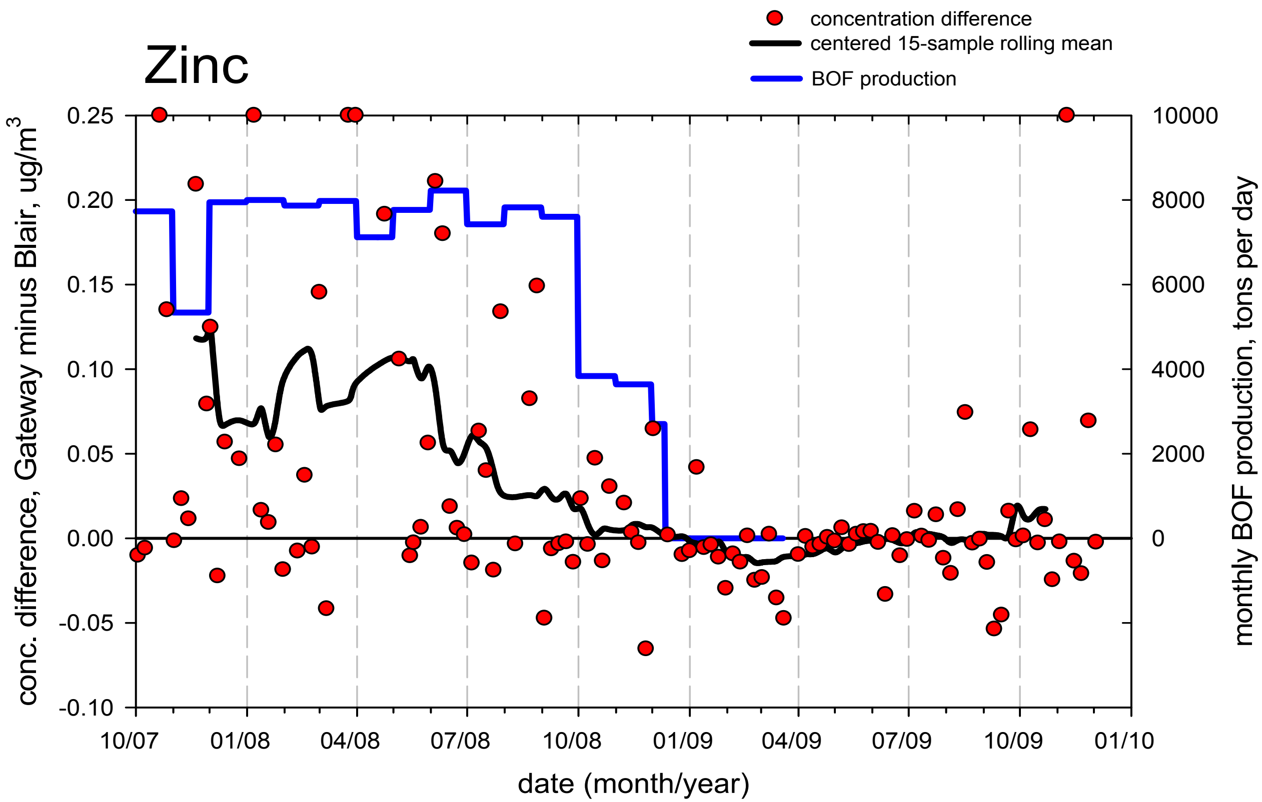
  --One blast furnace idled 10/8/2008; other BF idled 12/11/2008.

  --Steelmaking operations (BOF, LMF, casters) idled 12/12/2008.

  --Coke Batteries "hot-idled" March, 2009.

- All operations had resumed by January, 2010; (Note: GECC producing coke November, 2009)

Zn Concentration Difference Time Series: Before and During Facility Idling



Time series for the difference in zinc concentration between the Gateway and Blair stations. Red circles are the observed differences and the black curve is the 15-sample centered moving arithmetic average. Concentration differences outside the axis ranges have been set to the axis limits. The blue line is the steel production from the basic oxygen furnace ("Local Emission Source Contributions to Ambient Fine Particulate Matter in Granite City, Illinois", draft – February 28, 2010, Jay R. Turner, Washington University in St. Louis).

Memorandum of Understanding

- Enhanced operational monitoring for the BOF capture systems (within 2 months) and new control systems (within 3 months of start-up). Opacity readings on openings in the BOPF building (within two months).
- PM emission limits (January 1, 2012): 0.01 gr/dscf (BOP ESP stack), 0.005 gr/dscf (hot metal desulfurization/reladling, slag skimming, ladle metallurgy baghouse stacks; also for new tapping baghouse by March 31, 2013)

Memorandum of Understanding (cont.)

- Submit an application for a federally enforceable permit(s) to incorporate the prior requirements (within 2 months).
- Installation/operation of steam rings for oxygen lances (BOP shop) by October 31, 2011, barring appeal of the construction permit.
- Evaluation (and implementation?) of potential upgrade to BOF charging control system (within 9 months).

Charge Question #1:

What type of air quality problems are they trying to solve with their fine-scale modeling?

---Monitored violations of the annual $PM_{2.5}$ NAAQS in Granite City, IL and demonstrating attainment by 2012.

Charge Question #2:

Are there analysis techniques that have been useful to help validate emission biases, identify key sources in their area, and prioritize the inventory improvement work?

---Benefited from PMF receptor modeling, excess mass analysis, and inter-monitor speciation comparisons for source attri-bution (Jay Turner, Washington University)

Charge Question #3:

Which source categories did they improve and what methods did they use?

---Integrated iron and steel manufacturing (facility-specific point sources) through communications with company staff; stack test results; internal communications.

Charge Question #4:

What kind of before/after differences in emission estimates and modeling results are they seeing?

---Increases and decreases in emissions estimates, with expected patterns in modeling results.

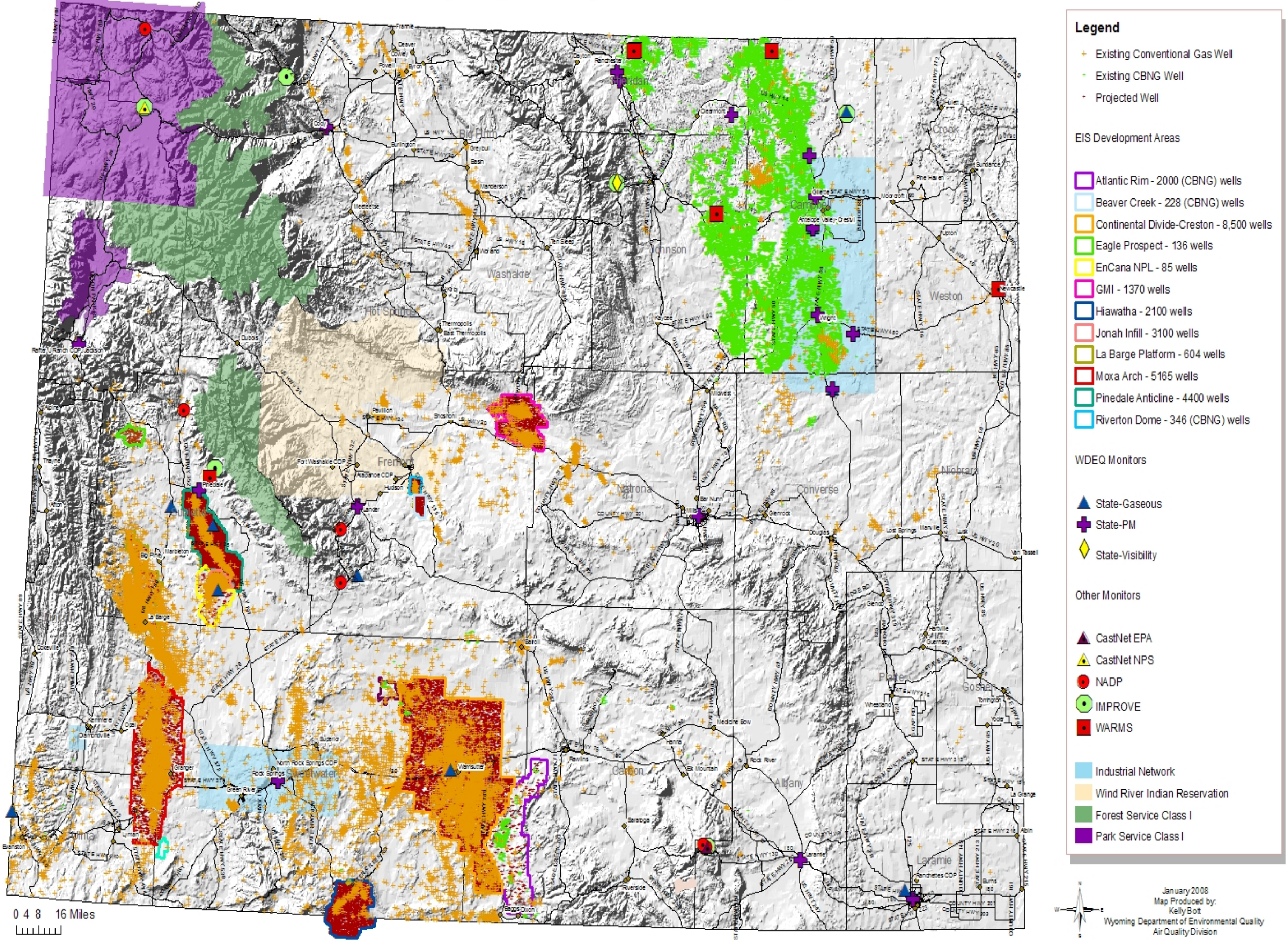
Charge Question #5:

Is there NEI analysis that would be particularly helpful to their efforts? At what step in their process?

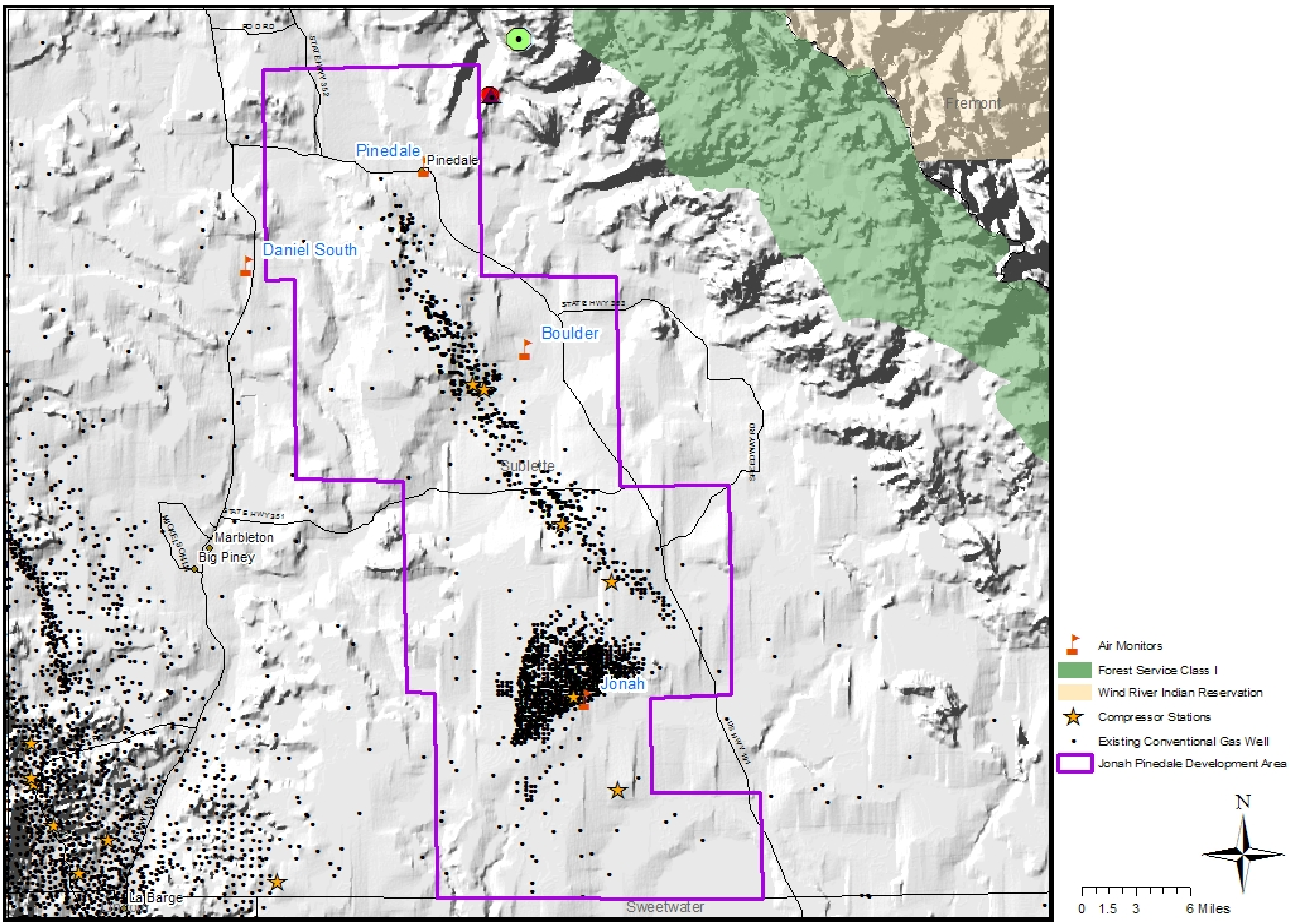
---Uncertain as to what NEI analysis could have enhanced this process.

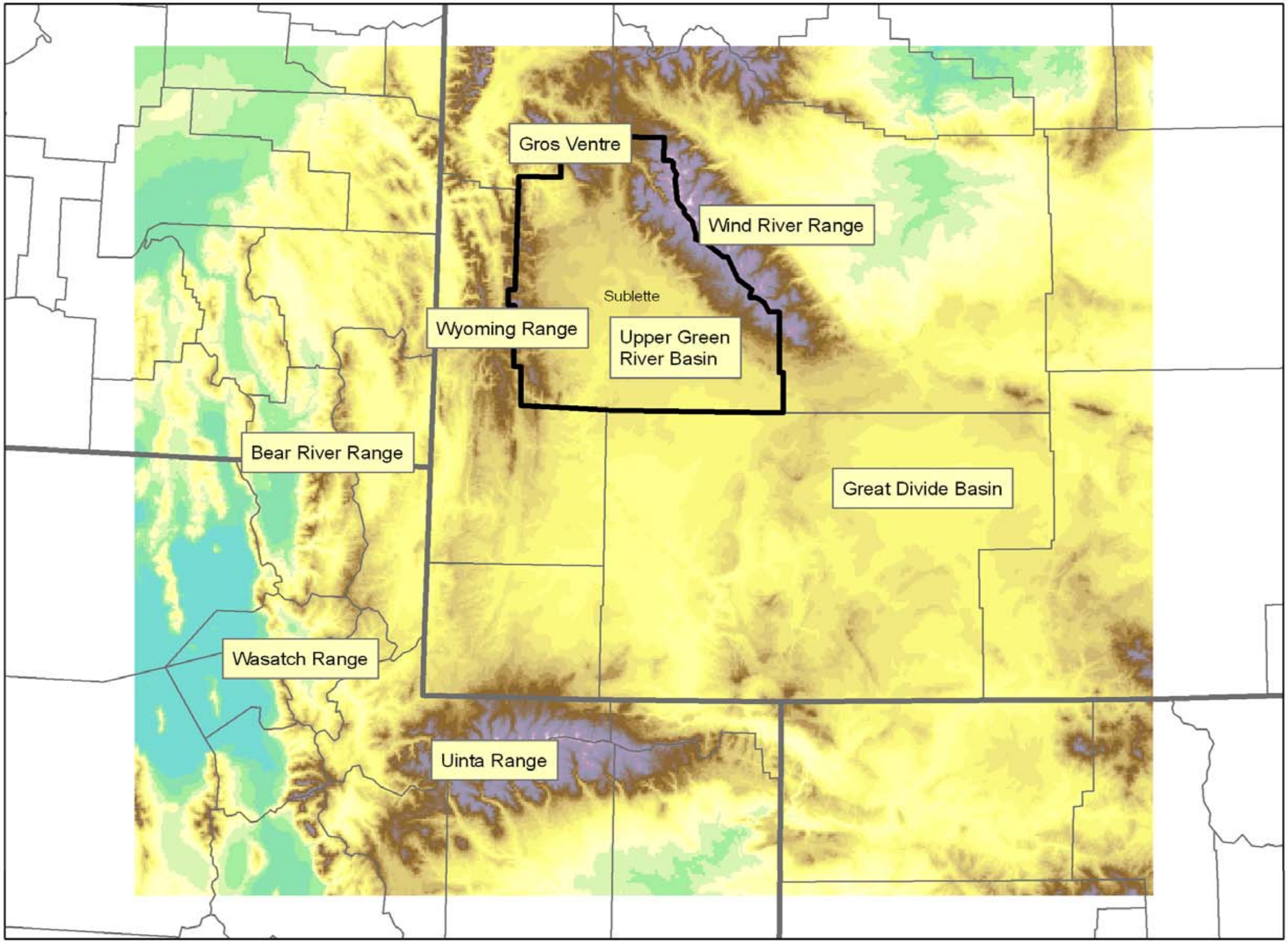
Ozone Events in the Upper Green River Basin of Southwestern Wyoming

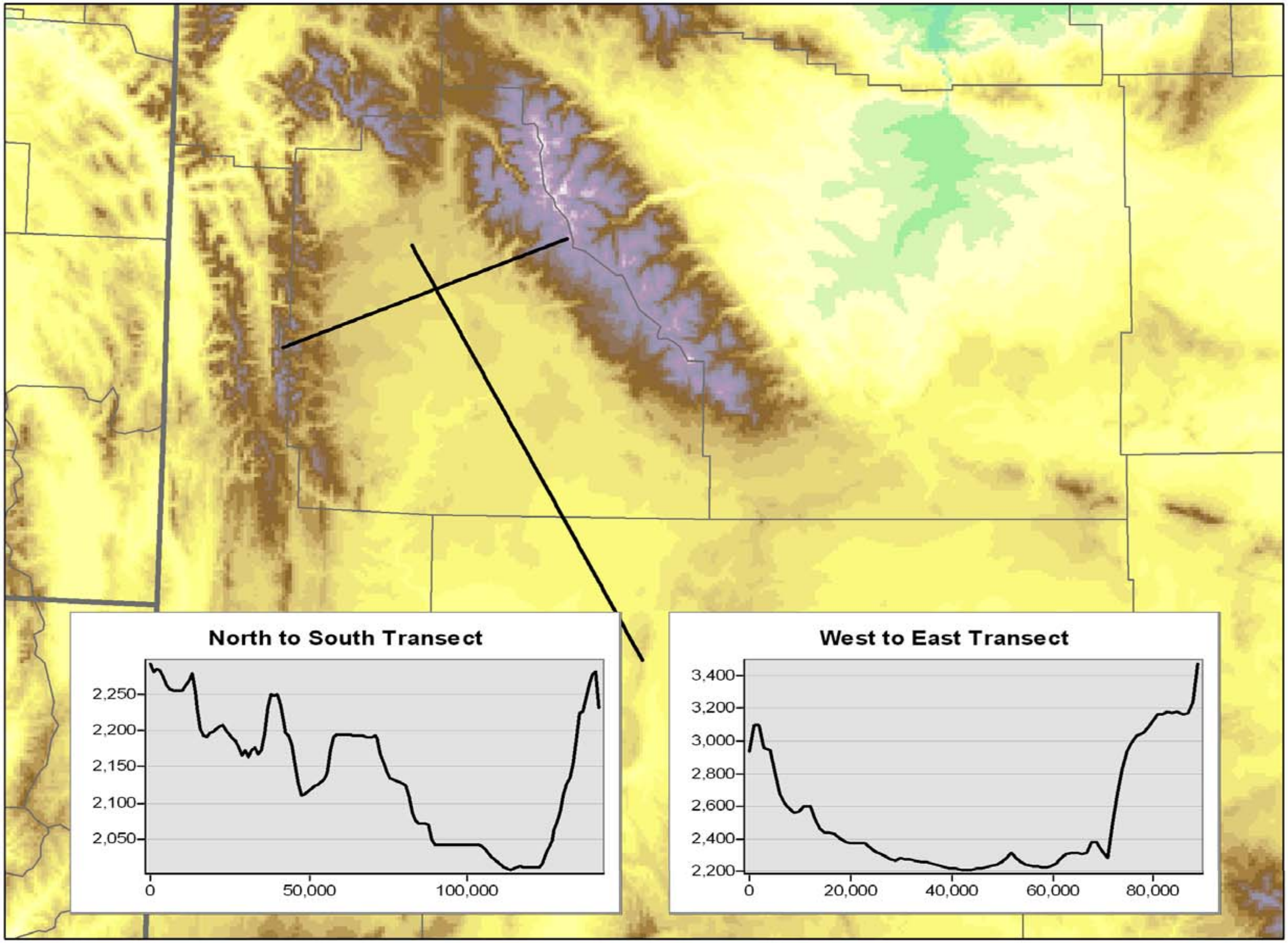
Wyoming Air Quality & Natural Gas Development



Local Anthropogenic Sources: 2008




Gros Ventre
Wind River Range
Sublette
Wyoming Range
Upper Green
River Basin
Bear River Range
Great Divide Basin
Wasatch Range
Uinta Range


North to South Transect
2,250
2,200
2,150
2,100
2,050
0
50,000
100,000
West to East Transect
3,400
3,200
3,000
2,800
2,600
2,400
2,200
0
20,000
40,000
60,000
80,000

Discovery of Winter Ozone

- Concerns about impacts from rapid oil & gas development led to new monitoring stations
- Elevated ozone discovered in February 2005 & 2006
- Launched winter ozone study to research ozone formation and meteorology

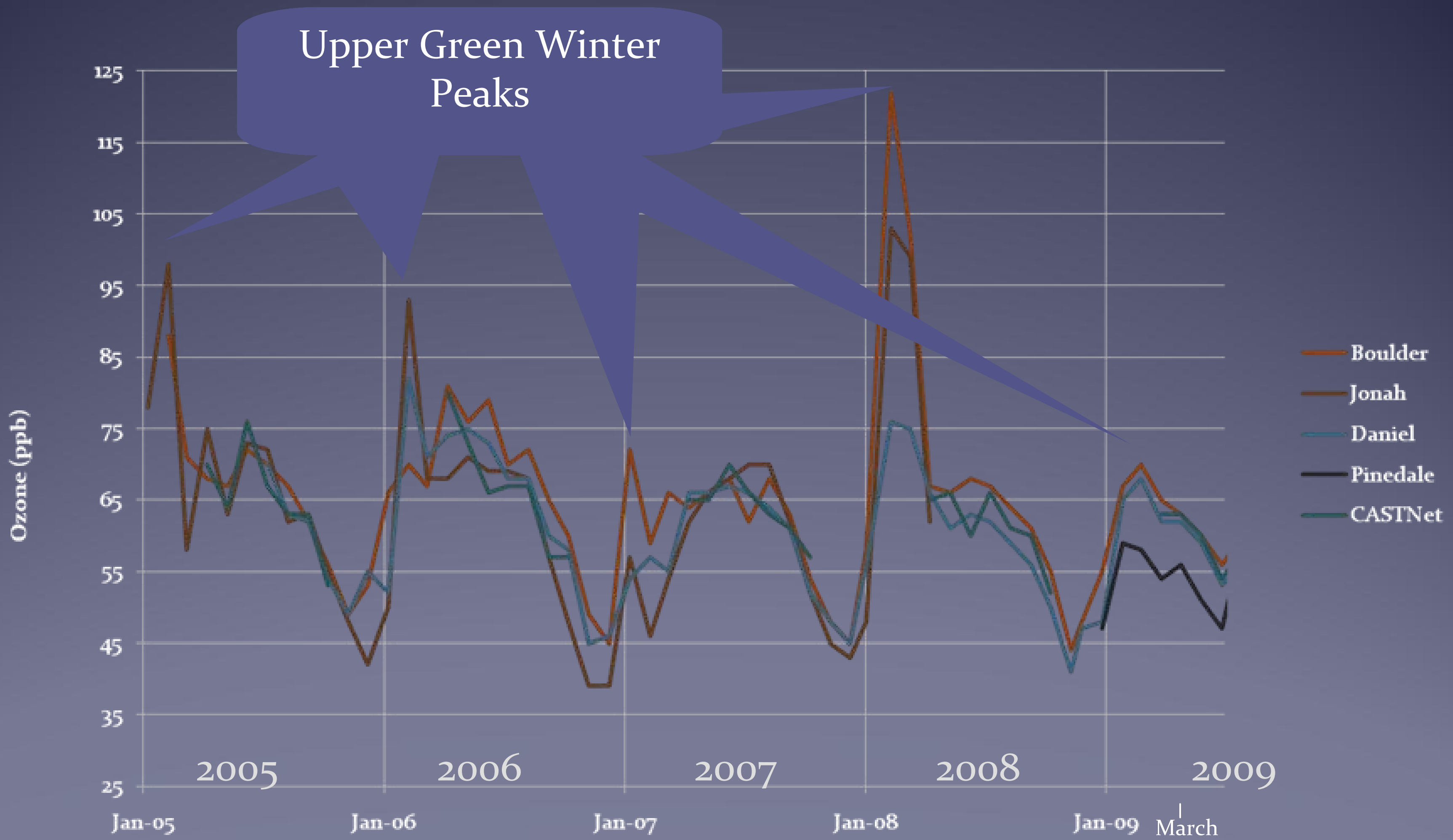
Jonah 2/27/06
8-hour max 93 ppb

Drill Rigs

Drill Rigs

Drill Rigs

Monitored Ozone: Monthly Max 8-Hour Avg.



Unique Features of SW WY Ozone Episodes

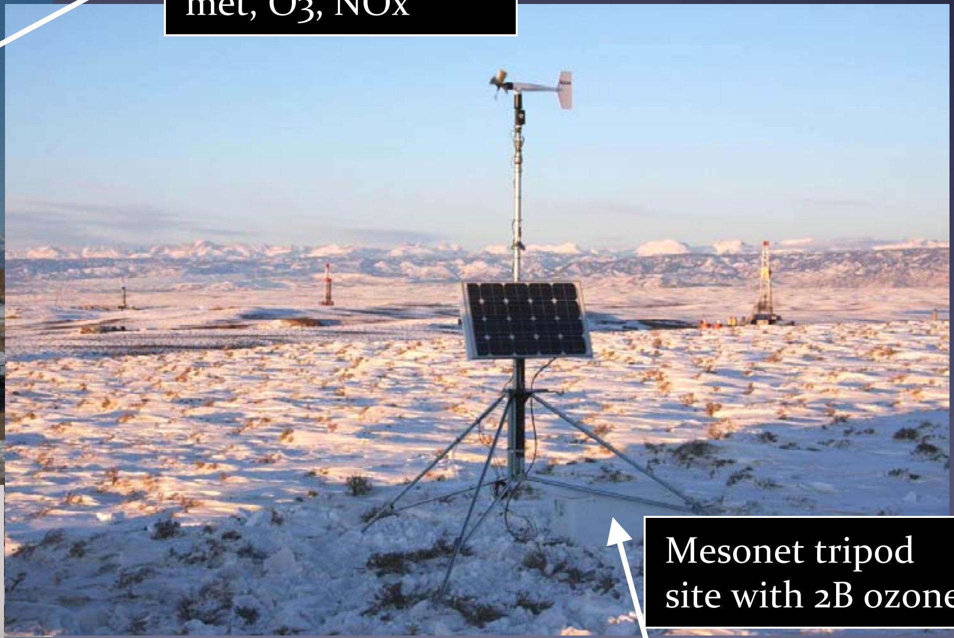
- Winter events
  - Low sun angle
  - Cold temperatures
- Rural location
- Significant oil & gas development

Field Study Objectives

- Characterize meteorological conditions during ozone episodes
- Determine horizontal and vertical extent of high ozone concentrations
- Measure UV radiation
- Characterize ozone precursor (VOC & NOx) concentrations
- Provide data for modeling

UGWOS Measurements

MiniSODAR with met, O_3, NOx



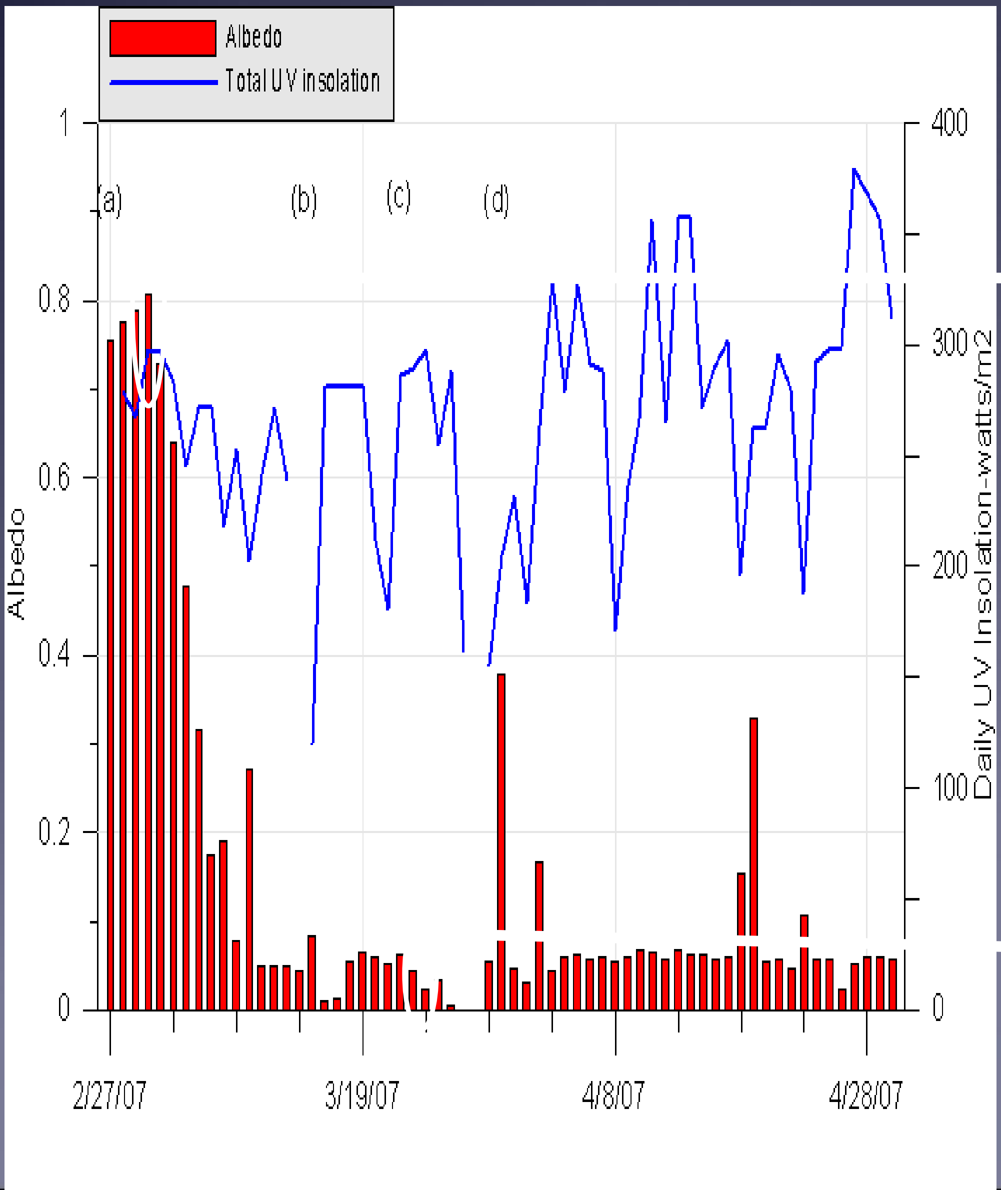
Mesonet tripod site with 2B ozone

Boulder I & II:

O_3, NOx, PM, CO, SO_2, UV, met, HONO

Key Points

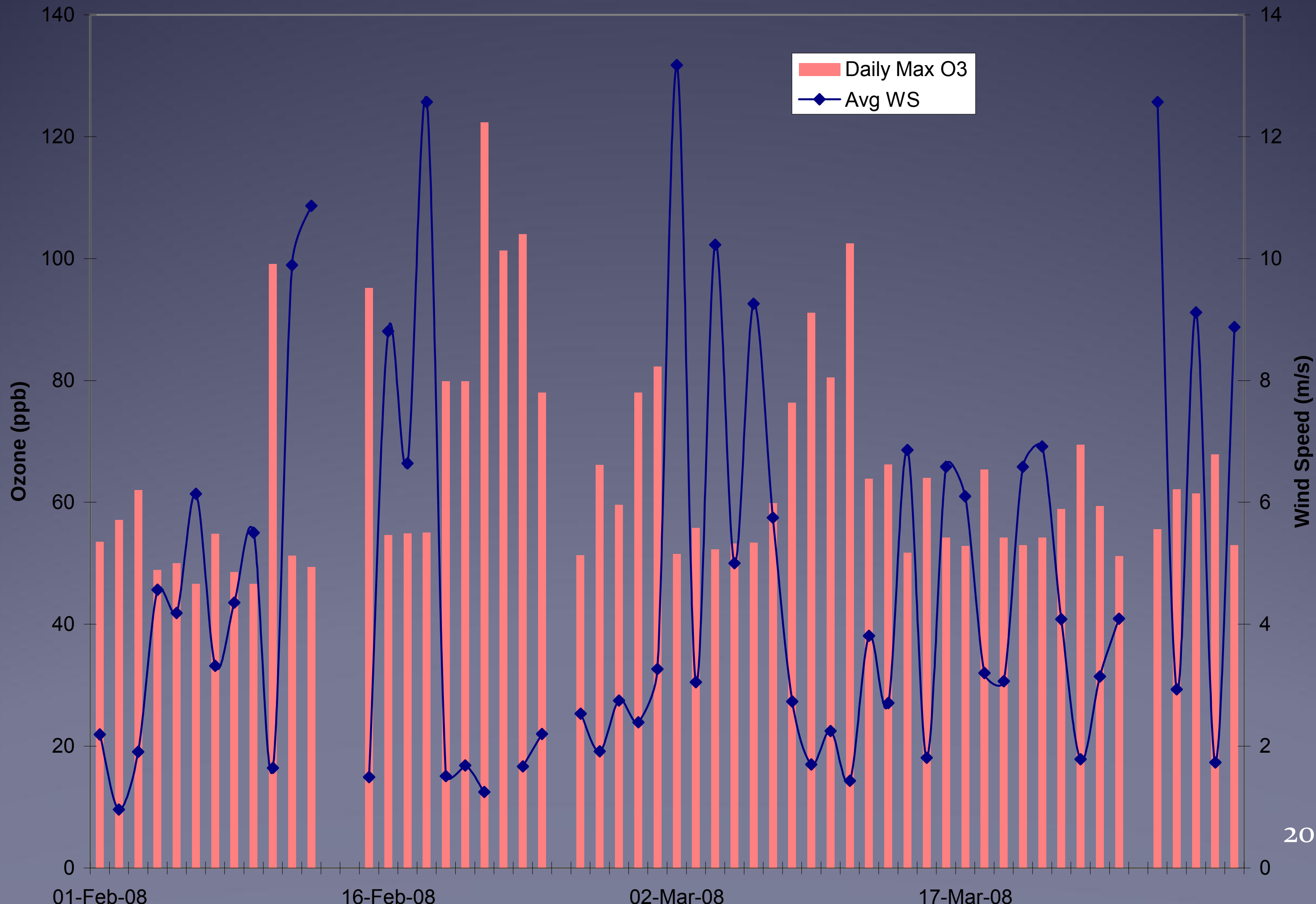
UV Radiation and Snow Cover



2 March: Albedo = 0.8 (snow)

23 March: Albedo = 0.06 (bare ground)

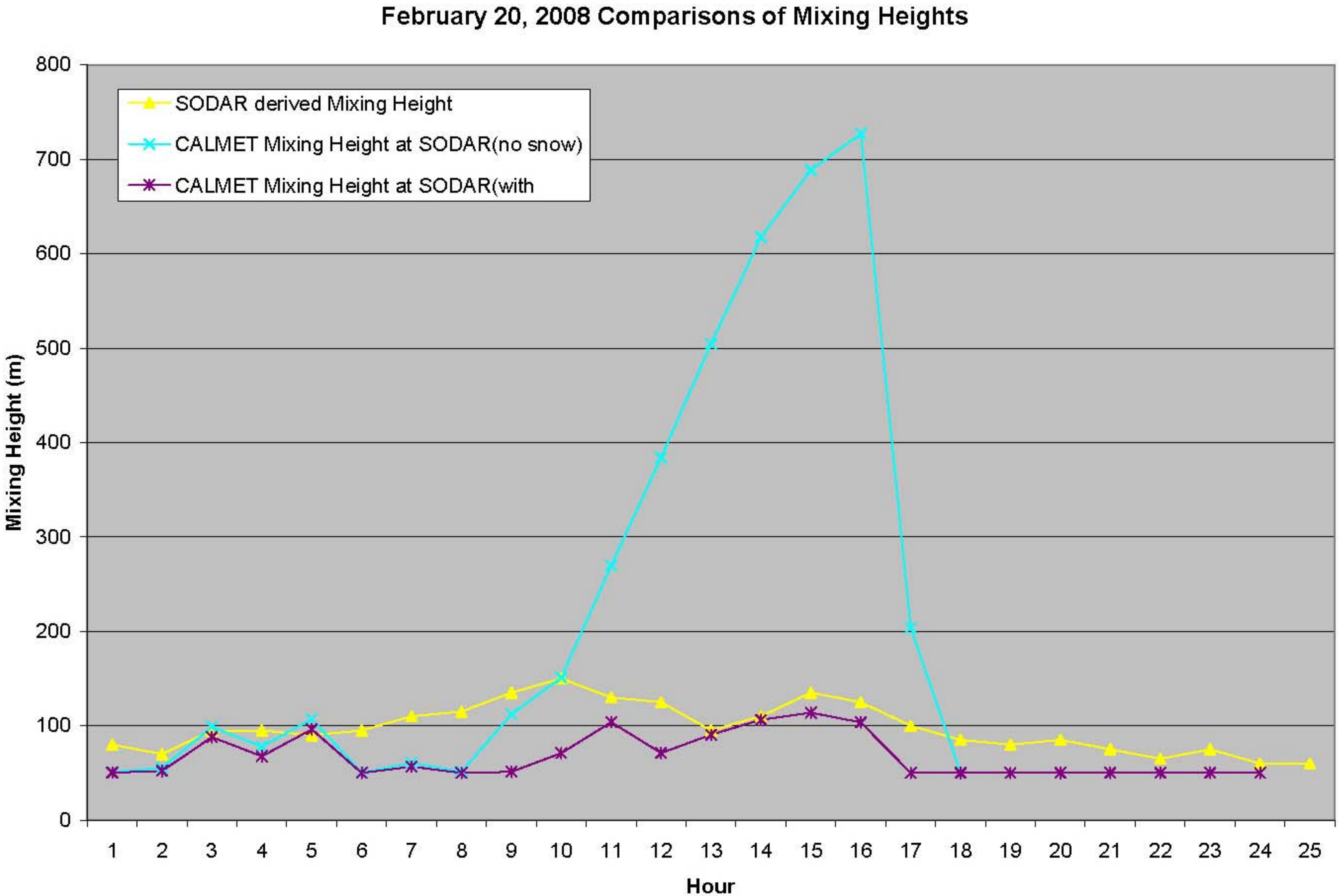
Low wind speed inhibits mixing Boulder wind speed vs. ozone



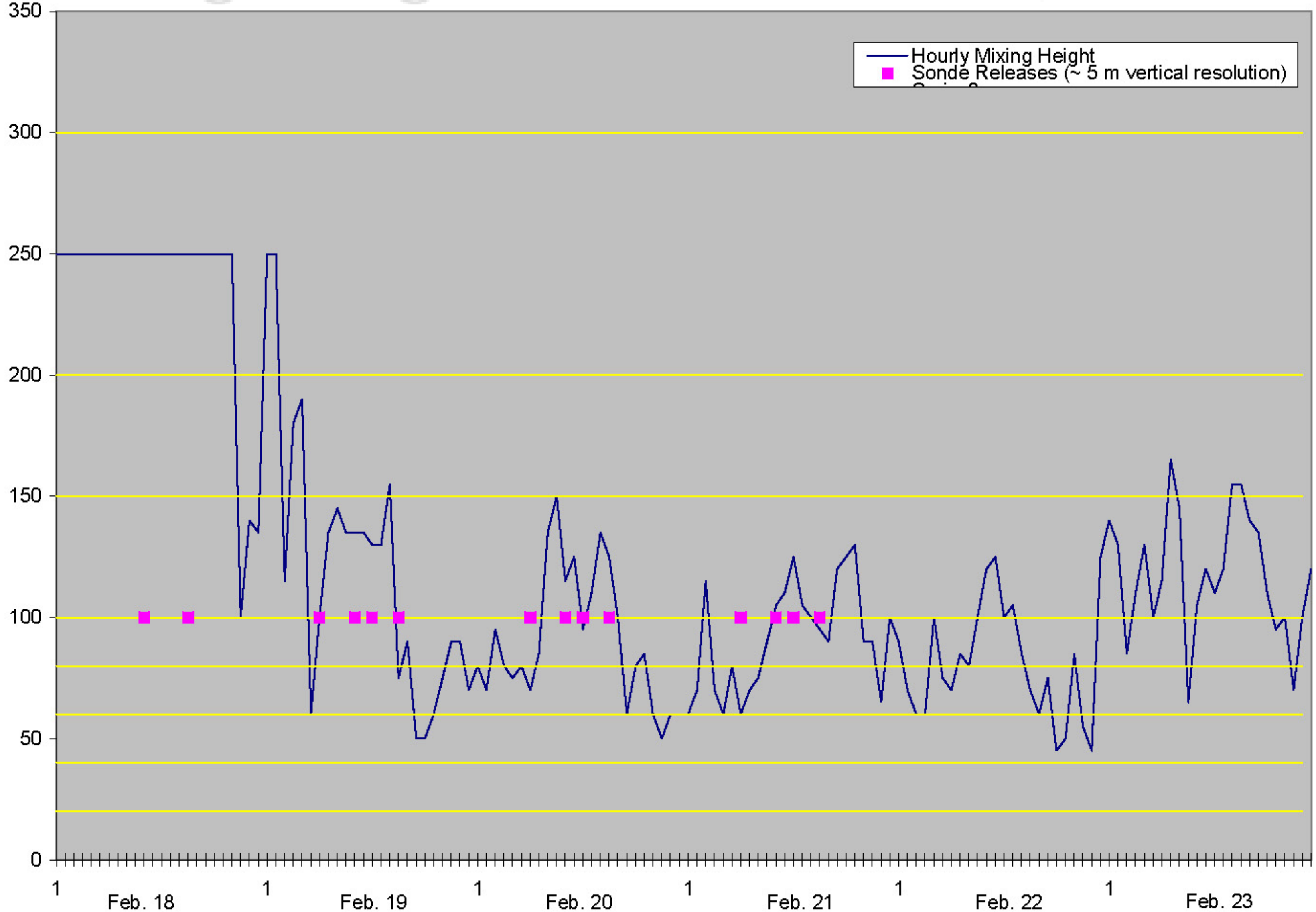
2008 Data

Daily Maximum 8-hour Average O_3

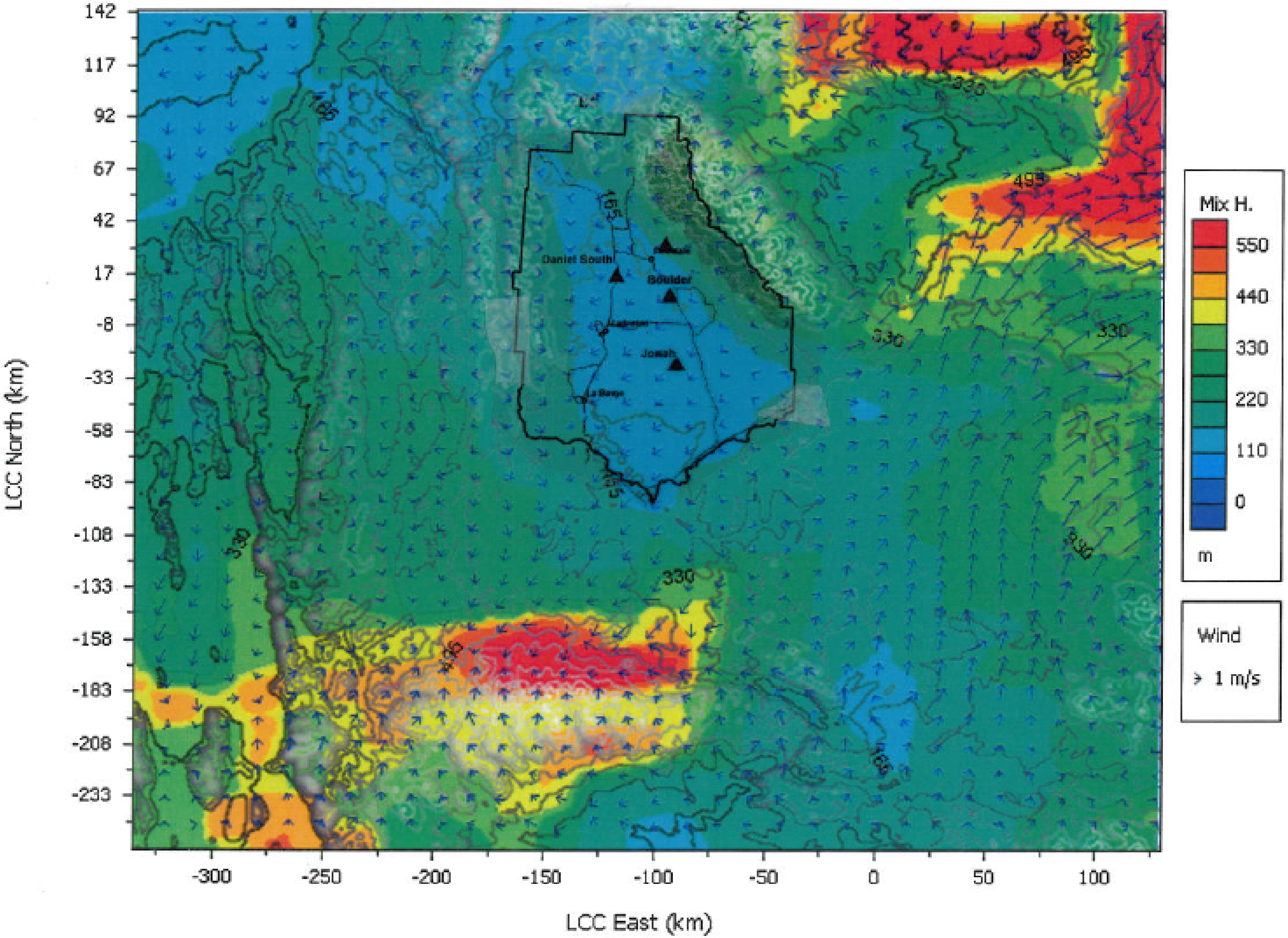
Date	Cora	Warbonnet	Haystack	Simpson	Airport	LaBarge	Jonah	Daniel	Boulder
2/10	58	79	48	44	61	49	56	71	99
2/15		71	49	44	80	53	82	60	95
2/19	68	68	55	51	55	63	80	74	79
2/20	75	80	74	85	67	74	75	76	79
2/21	64	88	78	76	87	79	84	62	122
2/22	68	99	83	83	82	76	102	76	101
2/23	90	80	93	68	82	61	76	74	104
2/24	68	79	63	57	63	67	65	70	78
2/29	53	62	70	64	67	55	77	53	78
3/1		70	75	70	70	63	68	72	82
3/8	64	59	62	56	70	48	37	57	76
3/9	70	79	69	65	78	60		58	91
3/10	63	73	76	77	69	61	76	74	80
3/11	61	68	87	74	89	56	98	57	102


February 20, 2008 Comparisons of Mixing Heights
SODAR derived Mixing Height
CALMET Mixing Height at SODAR(no snow)
CALMET Mixing Height at SODAR(with
Mixing Height (m)
800
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
Hour

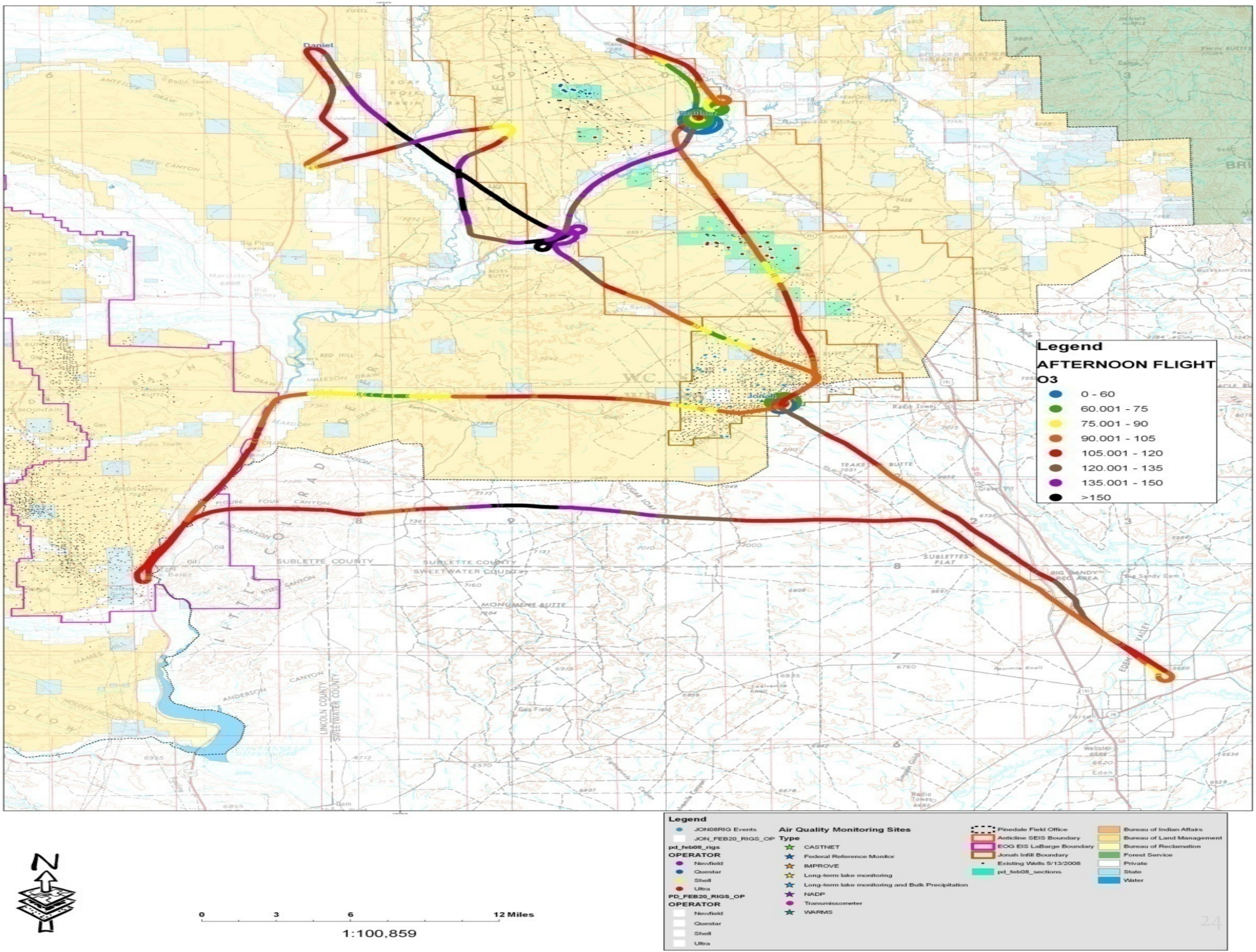
Mixing Heights – Feb 18-23, 2008



Feb 20 2008 (15:00) Mixing Height and Wind Vectors

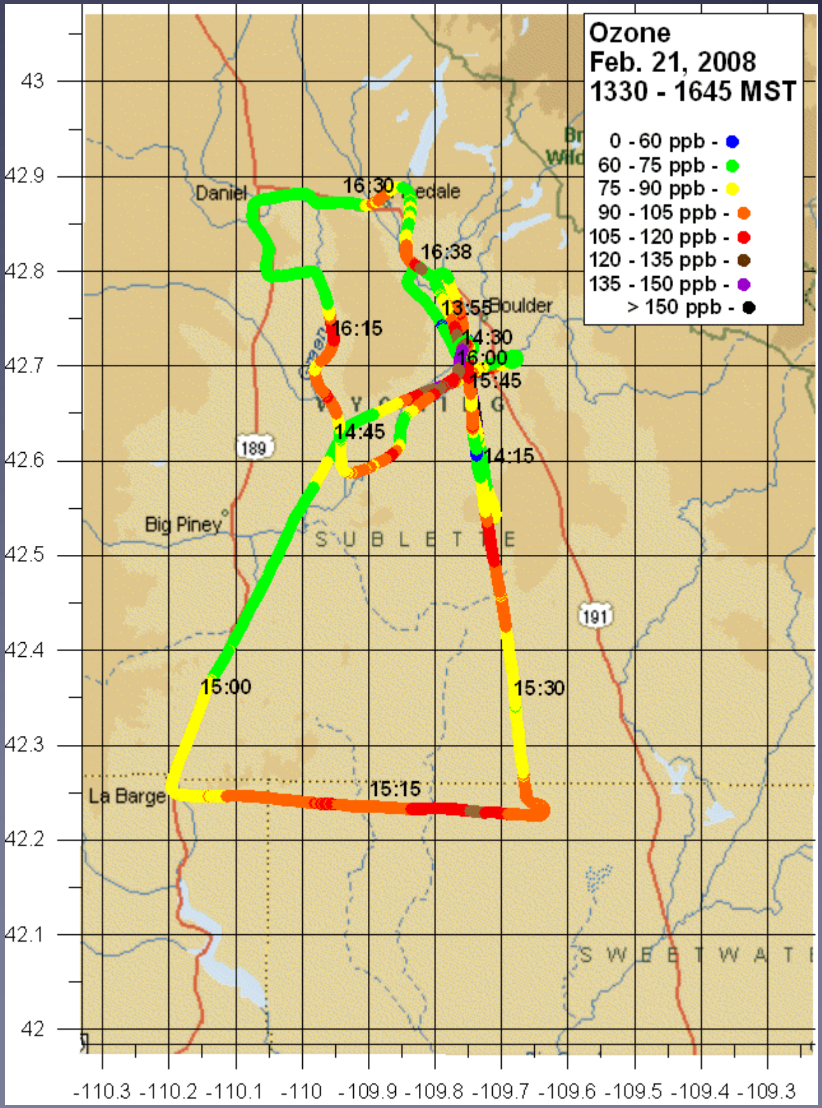


February 20th, 2008 Drill Rigs in Operation - JPDA



Large spatial variation throughout the basin

- Aircraft flights show that ozone is not well mixed throughout the Basin.
- Areas of greatest concentrations are hard to predict
- Readings consistent with surface network data
- Flight shown: February 21, 2008, 1:30 to 5:00 pm



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Key Characteristics of Winter O_3 Episodes

- Upper air high pressure ridge over Basin
  - trapping colder air at the surface
- Strong temperature (Capping) inversion that persists throughout the day
- Sunny skies
- Weak surface pressure gradients → light winds
  - diurnal recirculation (also influenced by topography)
- Snow cover across UGRB ; (fresh snowfall)
- VOC and NOx concentration measurements (UGWOS) show high (~40 to ~140) VOC/NOx ratios

Meteorology

Typical Characteristics of High Ozone Episodes in the Field

- Extensive snow cover, light winds, clear to partly cloudy skies
- Strong, surface based inversion
- Pollutants trapped in very shallow layer (less than about 150m)
  - High morning NOx and VOC
  - Limited horizontal mixing results in strong spatial gradients
- Morning NW to afternoon SE wind reversal
  - Most common at Jonah; also seen at other sites
- Elevated ozone most common along Pinedale Anticline and in and around the Jonah field
- Polluted conditions can develop very quickly – within 24 hours of clean conditions

Challenges of Modeling Winter Ozone

- Current models are developed for summer time, urban sources with relatively little terrain and near-sea level conditions
- AQD needs to develop specialized inputs
  - wind-field for complex terrain and low wind speeds
  - daily actual inventory for minor sources
  - upgrade chemistry modules for unique VOC inventory

Comparing Typical Ozone Problem Areas With Wyoming Ozone Problem Areas

Typical

1. Summertime exceedances
2. Urban setting
3. Major sources key players
4. Background levels relatively low
5. Models available for predicting ozone
6. VOC/NO_x ratios relatively low
7. Flat terrain
8. Available regional level met data useful
9. Urban chemistry modules useful
10. Large research base on summertime ozone health effects
11. Longer episodes
12. Nonattainment requirements useful for reducing emissions

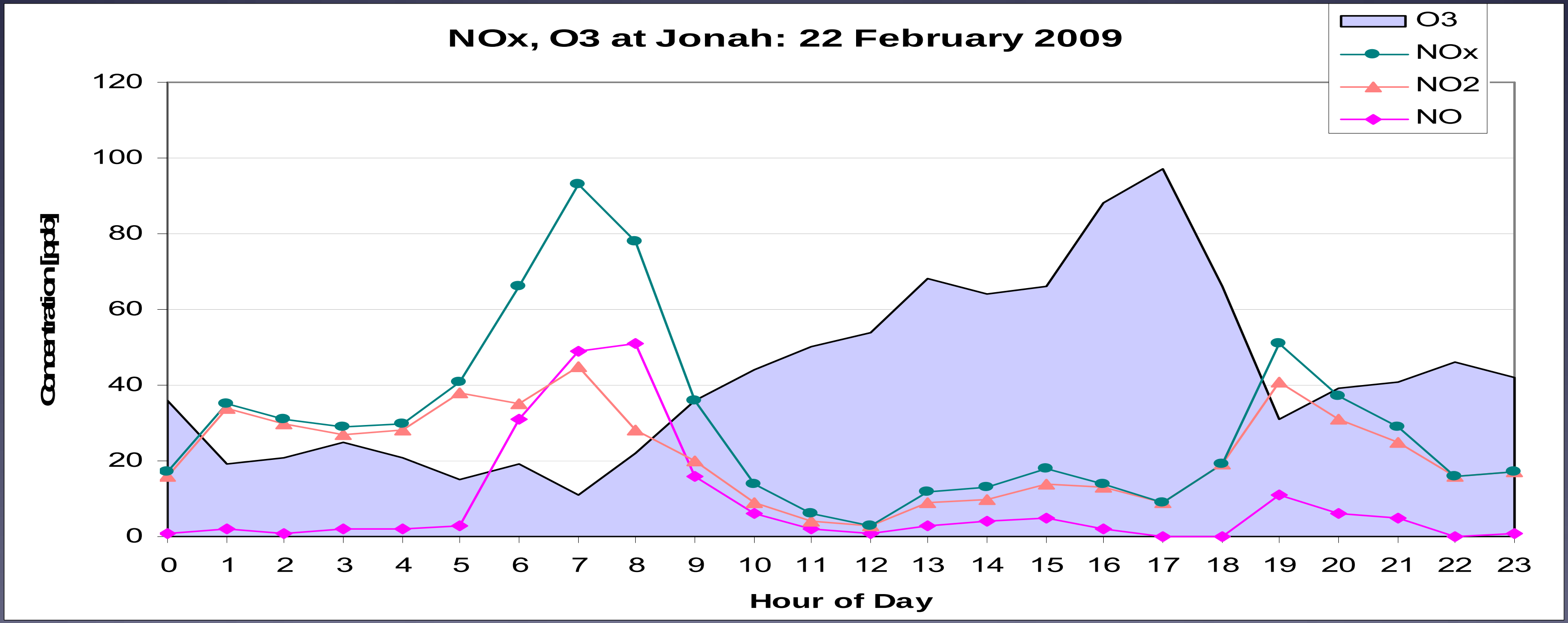
Wyoming

1. Winter/spring exceedances
2. Rural setting
3. Minor sources key players
4. Background levels high
5. No models available for predicting ozone
6. VOC/NO_x ratios high
7. Complex terrain
8. Specialized wind fields developed
9. Specialized chemistry modules needed
10. No research base on wintertime ozone health effects
11. Short-term episodes
12. Nonattainment requirements not useful for reducing emissions

Other Measurements

- Continuous CO and SO_2 (2009 study)
- Ammonia and particulate nitrogen
- Some canisters analyzed for CH_4 and CO
- NOy and PAN (2009 study)
- NO_2 photolysis (2009 study)
- HONO (2010 study)

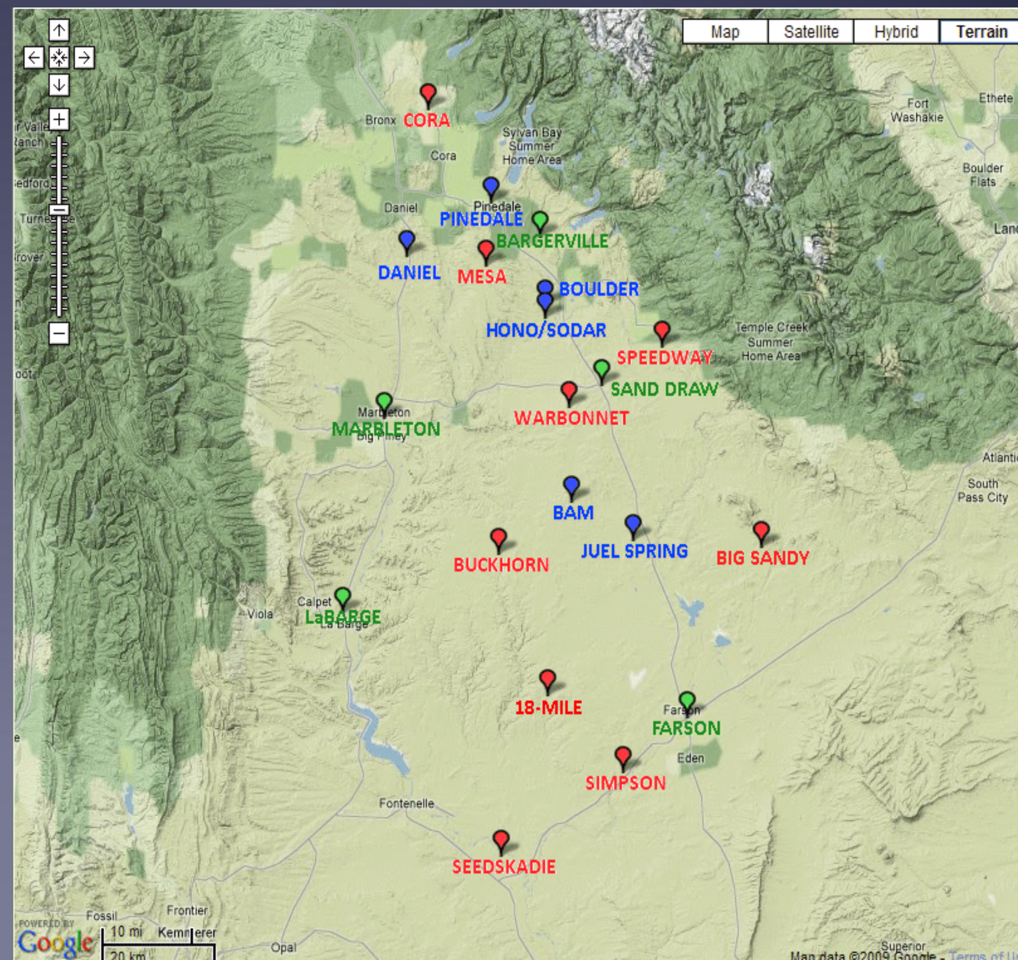
NOx at Jonah



- Typical high ozone day at Jonah
- High morning NO with wind shift → strong local source
- O3 peak in late afternoon coincides with wind shift to SE

UGWOS ’10 Monitoring Sites

- Mesonet Sites
- Permanent Sites (except BAM & HONO)
- Air Toxics Study Sites



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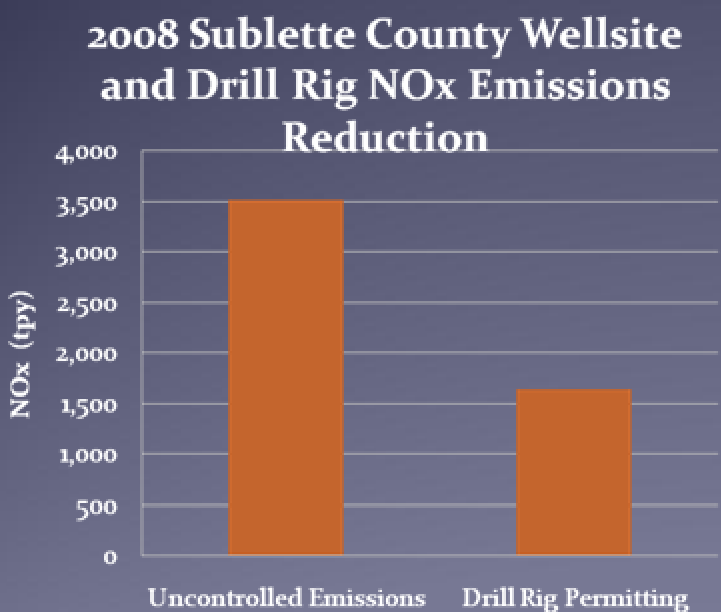
What is Wyoming Doing to Reduce Ozone in Sublette County?

- Permits
- Accelerated management of emissions from sources without controls
- Contingency Plans
- Cooperative efforts with local governments and industry

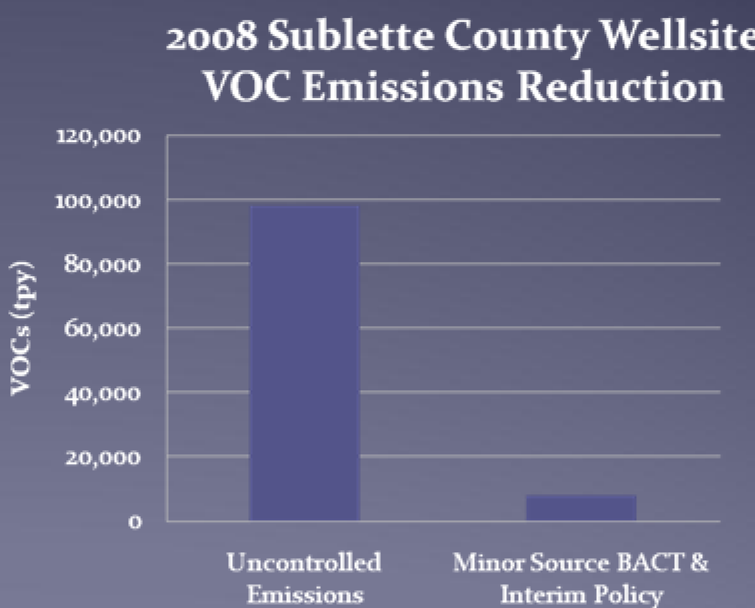
Drill Rig Permitting

- Approximately 60 drill rigs in JPDA covered by permits
- Control methodology utilized on drill rig engines
  - Diesel Engines
    - Selective Catalytic Reduction (SCR)
    - Oxidation Catalyst
    - Limit Operating Hours
  - Natural Gas Engines
    - Lean Burn Technology
    - Oxidation Catalyst

AQD's programs proactively reduced NOx and VOC's in the area of concern



Note: Wellsite and drill rig NOx emissions 51% of Sublette County total



Note: Wellsite VOC emissions 65% of Sublette County total

Portable 4-Phase Completion Equipment

Wyoming DEQ/AQD Web Sites

- Oil & Gas Permitting Home Page
  - http://deq.state.wy.us/aqd/oilgas.asp
- Oil & Gas Production Permitting Guidance Document
  - http://deq.state.wy.us/aqd/Oil%20and%20Gas/March%202010%20FINAL%20O&G%20GUIDANCE.pdf
- Emission Inventory Home Page
  - http://deq.state.wy.us/aqd/ei.asp

Minor Source BACT

- New or modified sources are subject to BACT
- BACT for production sites requires VOC emissions to be controlled from
  - Condensate and water tanks
  - Dehydration units
  - Pumps
  - Controllers
  - Well completions
- BACT – IC engines
  - 0.5 – 1.0 g/hp-hr NOx

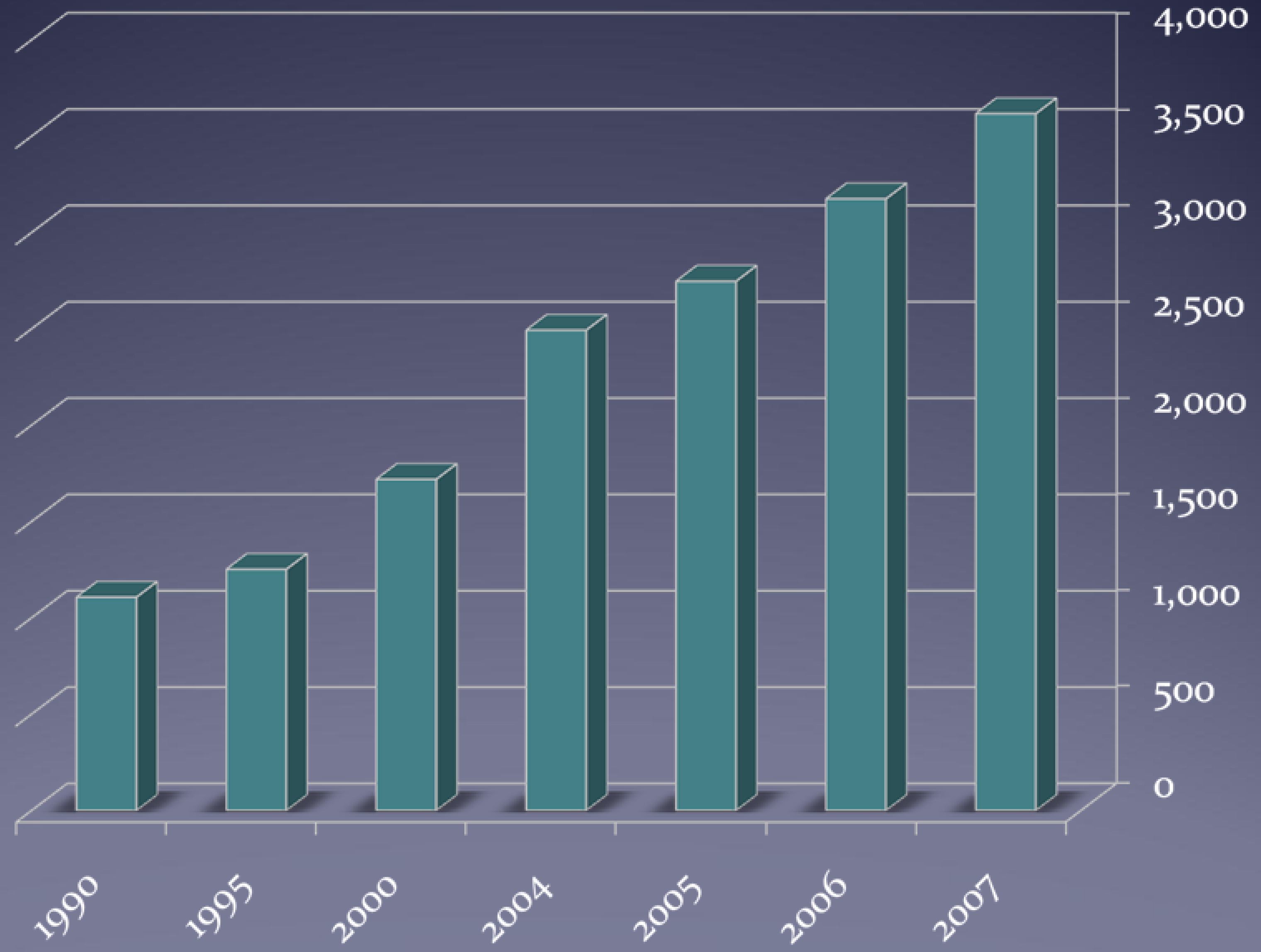
Cooperative Efforts

- AQD, Sublette County Commissioners and Dept. of Health working together on air toxics study and health risk assessment
- AQD & Commissioners working on “boundary” monitoring
- Worked with oil & gas operators to fund new monitoring and investigation of ozone formation
- Worked with oil & gas operators to implement leak detection programs (using FLIR technology)
- University of WY partnership

Public Outreach

- Instituted quarterly public outreach meetings
- Website dedicated to communicating ozone information for the county
- Forecasting for potential episodes and public alert system
- Real-time ozone website and began uploading real-time data to EPA's AirNow

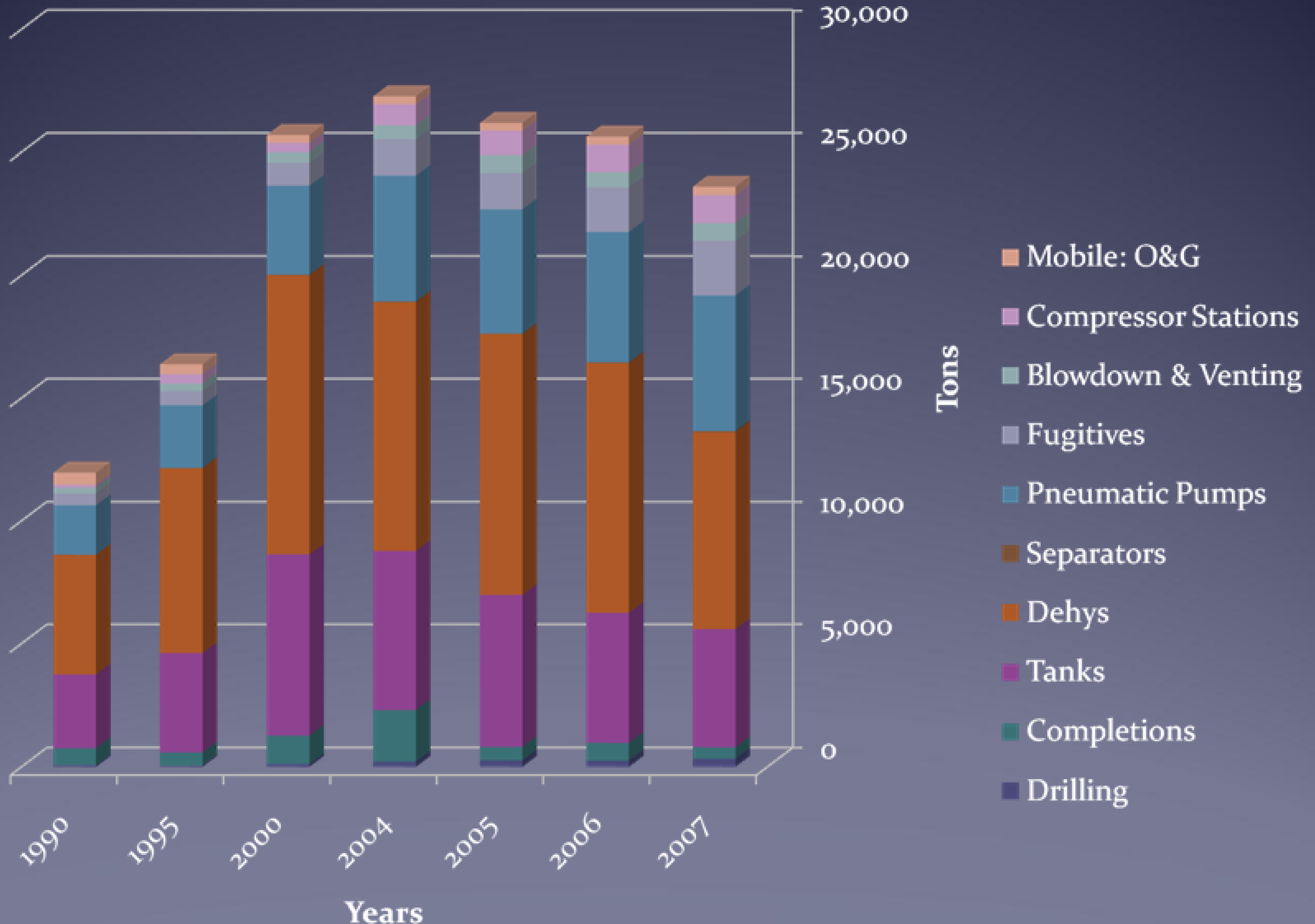
Total Sublette County Wells



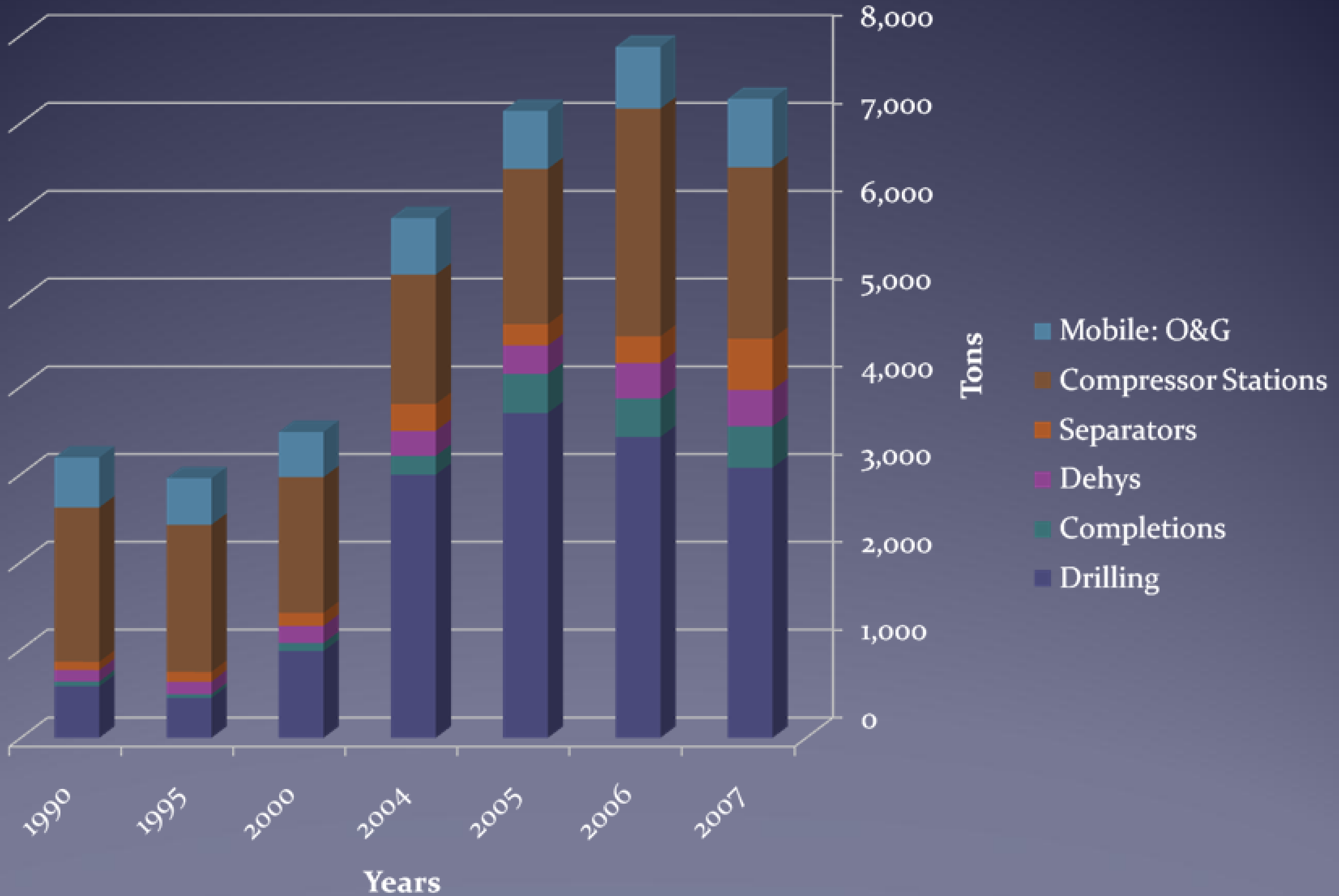
Proposed Well Locations

Sublette County Gas Production

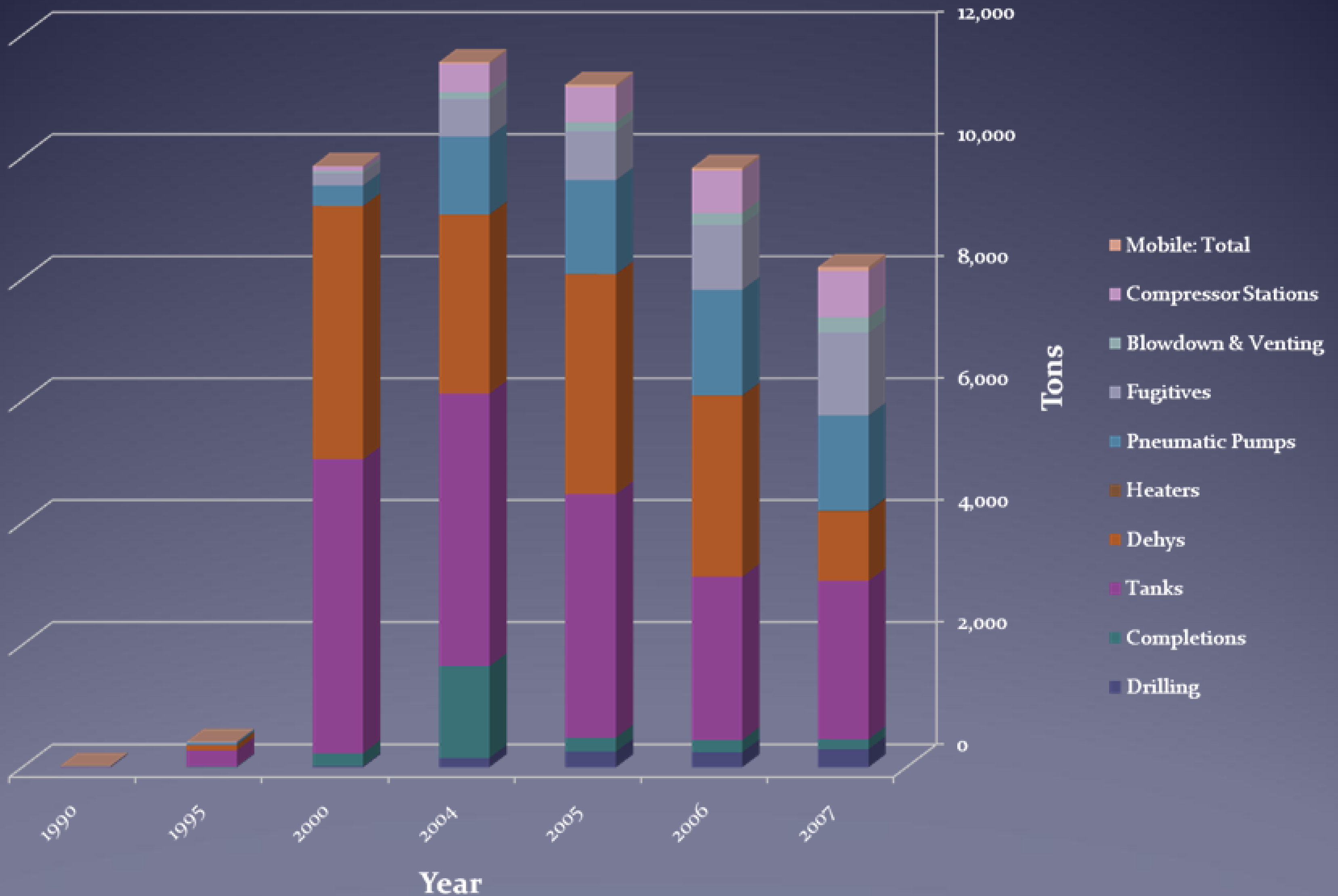
Sublette County VOC Emissions by Source



Sublette County NOx Emissions by Source



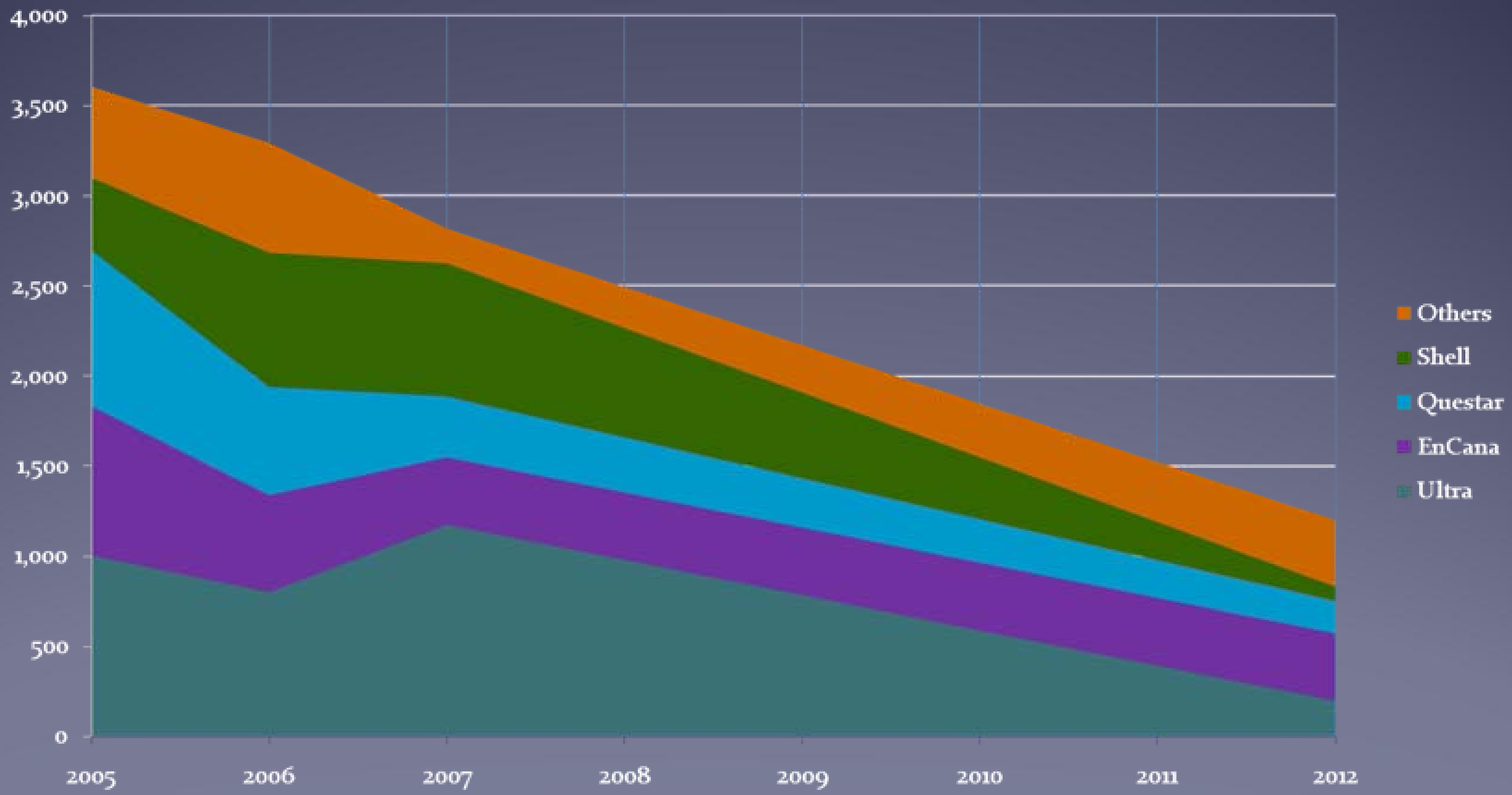
JPDA VOC Emissions by Source



ATTORNEY-CLIENT DELIBERATIVE PROCESS
3/4/08

JPDA NOx Emissions by Source

Estimated JPDA Drill Rig Engine NOx Emissions



Cat 3512 (~1500 HP each) Diesel Generator Stacks w/SCR

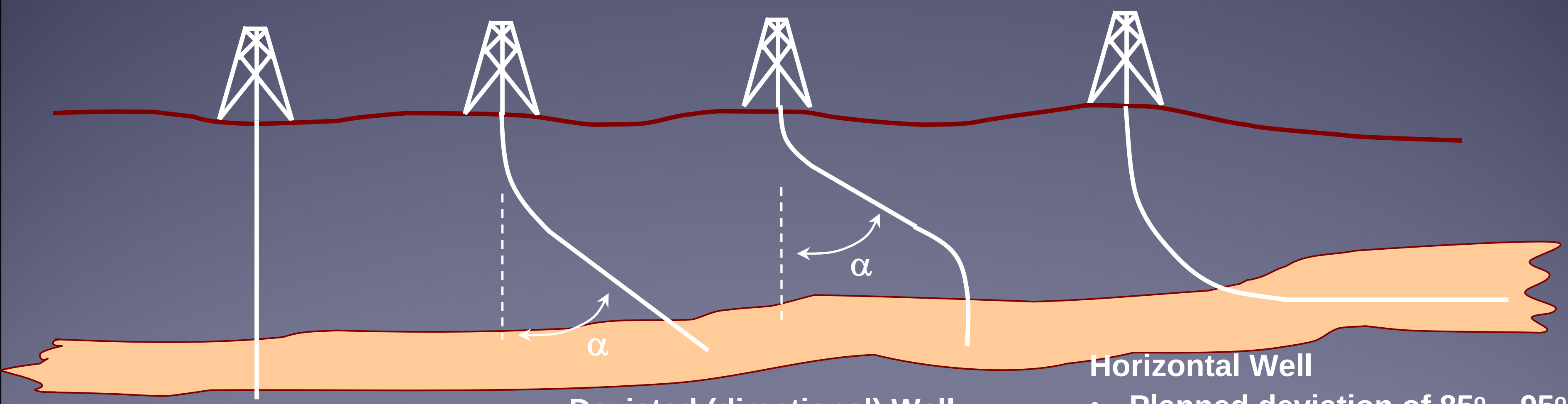
Note: Typically all 3 generators operate only during the drilling of the first 2,500 feet of each well with 2 generators operating for the rest of the drilling.

Insulated Urea storage tank used w/SCR to control NOx emissions from the diesel generators.

Directional Drilling

At the basic level:

- **A deviated (or directional) well is a well that has been intentionally deviated from vertical. The deviation (or inclination) is measured from the vertical.**
- **A horizontal well is a deviated well with an inclination at or near 90º**



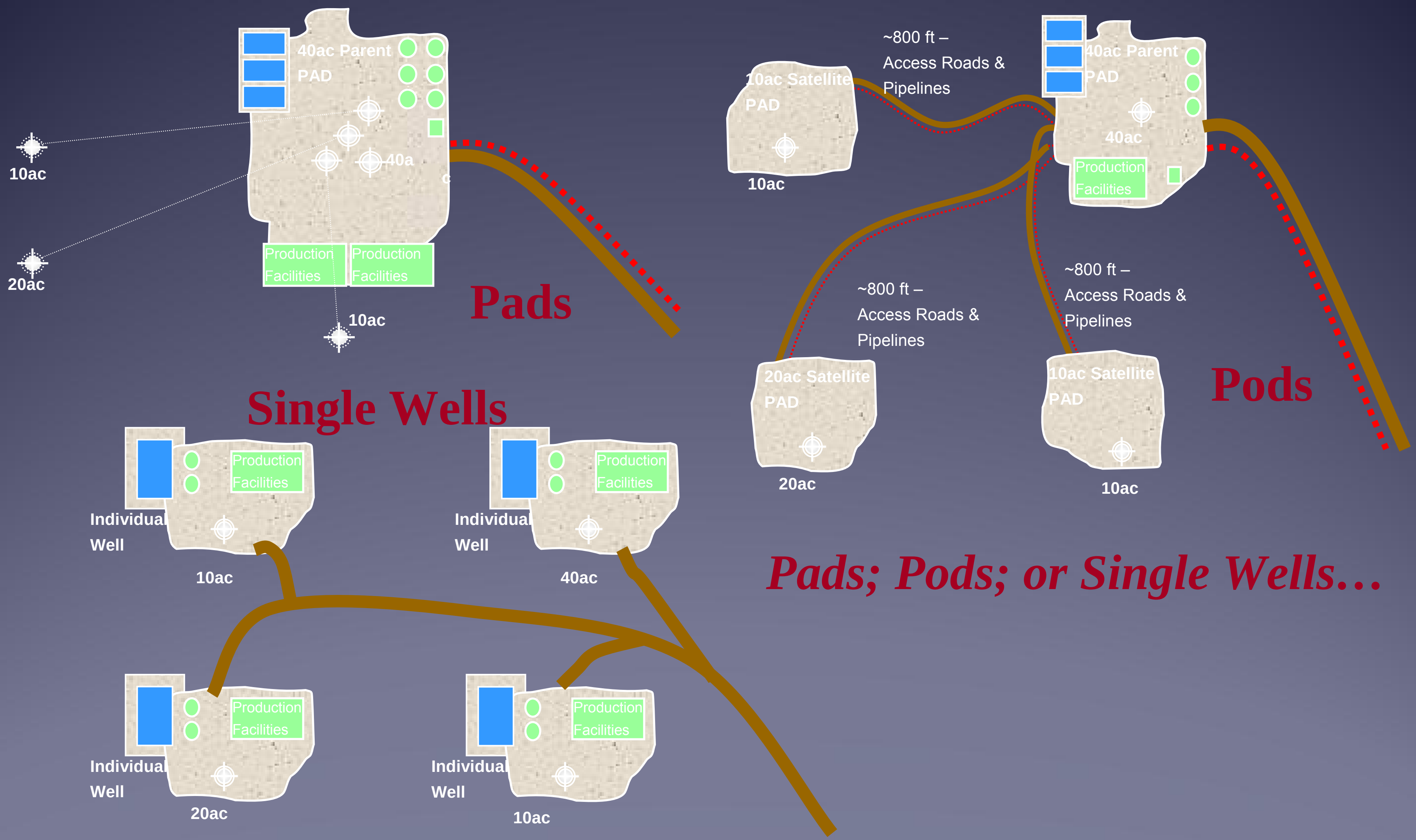
Vertical Well
- Some unintentional deviation
- Typical inclination < 3º

Deviated (directional) Well
- Planned deviation from vertical
- Planned direction (azimuth)
- Inclination up to 85º

Horizontal Well
- Planned deviation of 85º – 95º
- Planned azimuth

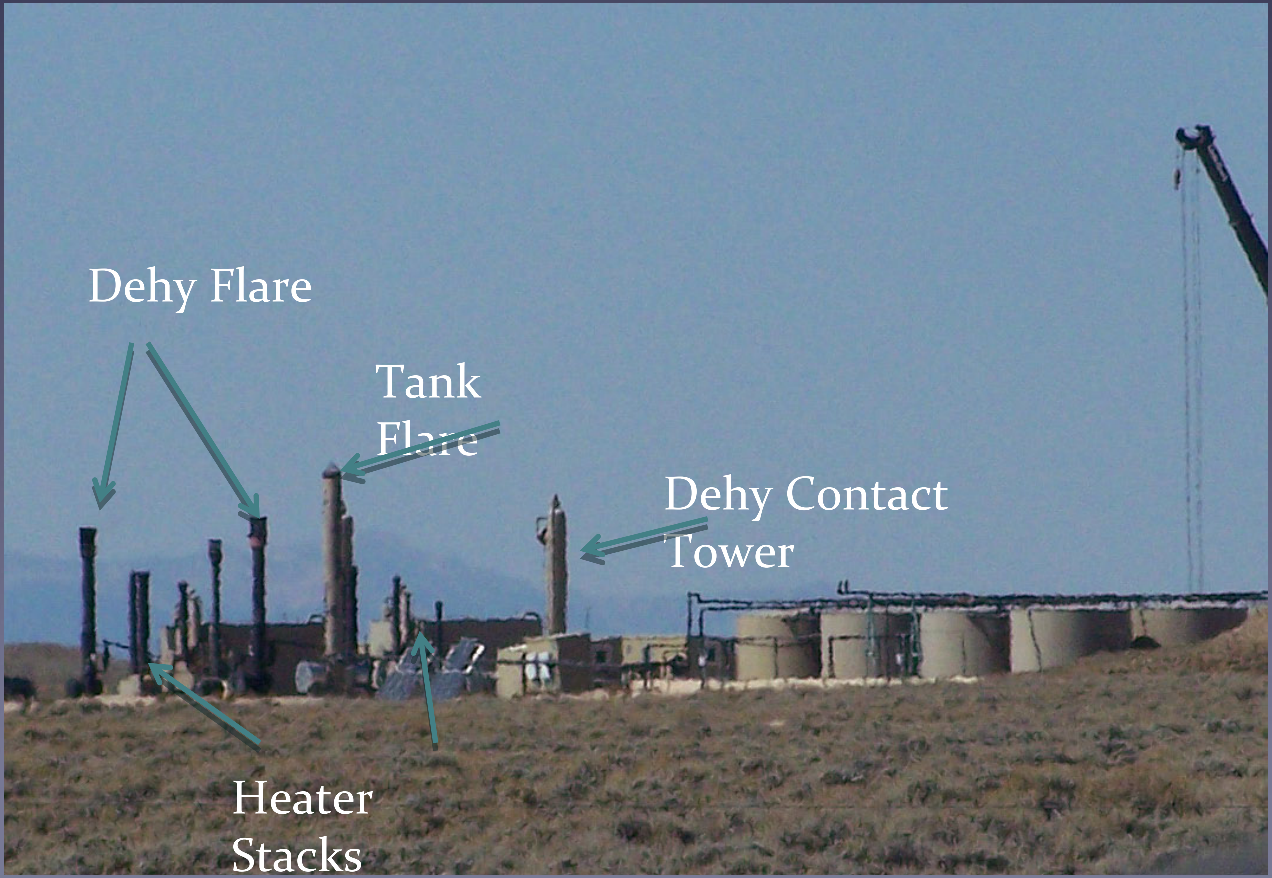
Proposed Well Locations

Development Options



Pads; Pods; or Single Wells…

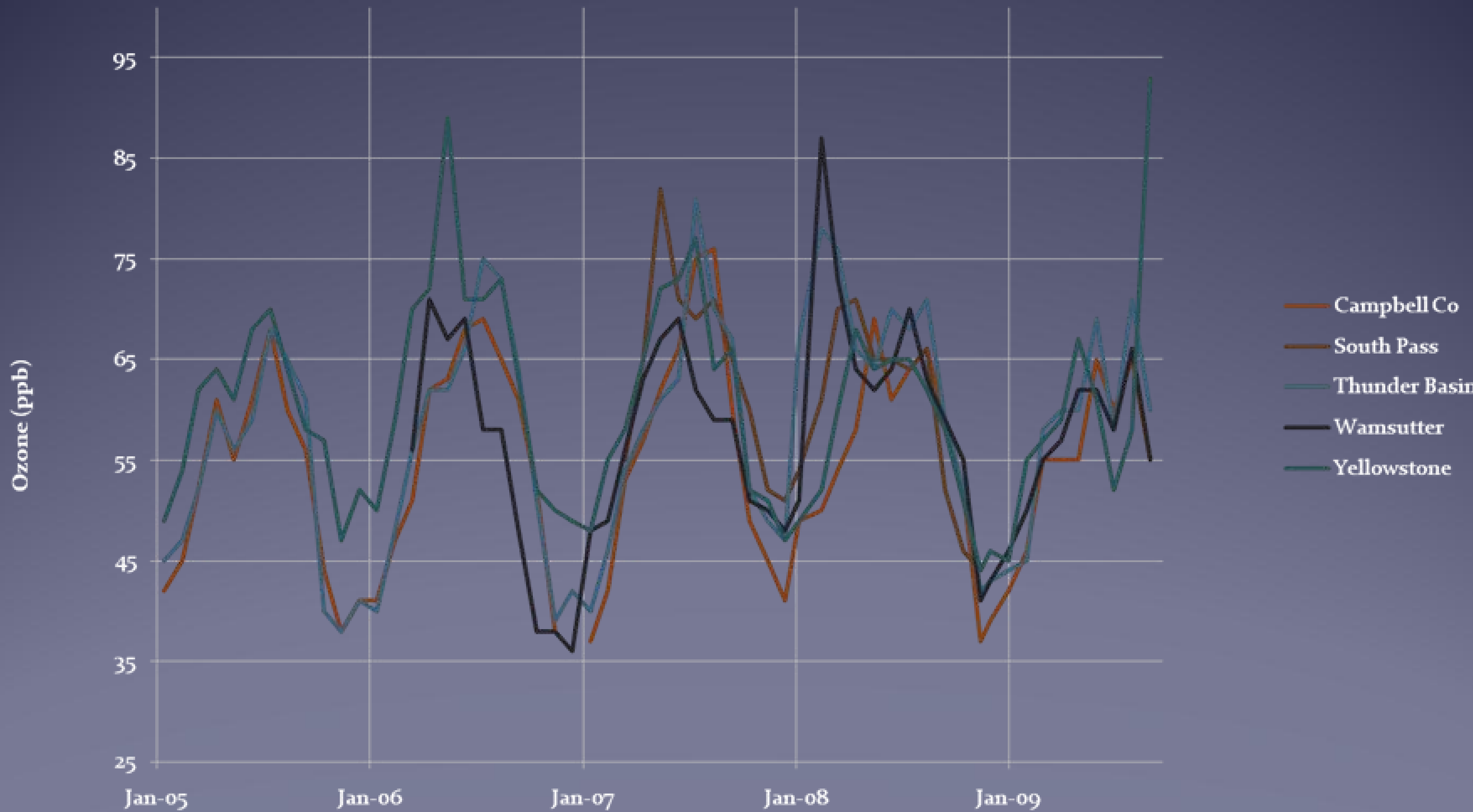
Multiple Well Facility



Questar Gas Management's Liquids Gathering Facility

Jonah Gas Gathering's Paradise Compressor Station

Monitored Monthly 8-Hour Maximum Ozone at Other WY Sites



Charge Questions

- **1) What type of air quality problems are they trying to solve with their fine-scale modeling?**

- In February of 2008, Wyoming exceeded the then ambient 8-hour ozone standard of 80 ppb. The highest 8-hour ozone reading recorded at the Boulder monitoring station was 122 ppb. As a result of the exceedences of the standard, the Wyoming DEQ/AQD, under a cover letter from the Governor, submitted an Ozone SIP to EPA for the Upper Green River Basin (UGRB) in Sublette County, Wyoming. Even though EPA has taken no action on the Wyoming SIP as of May 27, 2010, the AQD continues to develop models and refine inventories for the UGRB. As of April, 2008, the 8-hour ozone standard had only been exceeded once in Wyoming. This was the South Pass monitor in Fremont County, Wyoming which the WDEQ flagged as an exceptional event. The AQD will submit an exceptional event report to EPA.

Charge Questions

- **2) Are there analysis techniques that have been useful to help validate emission biases, identify key sources in their area, and prioritize the inventory improvement work?**

- Since 2004, the AQD has been collecting inventories from all oil & gas operations located in the Jonah and Pinedale fields within Sublette County, Wyoming. There were 1,811 (539) wells in the Jonah field in 2008 (2004). There were 1,153 (362) wells in the Pinedale field in 2008 (2004). There were 2,339 producing wells in Sublette County in 2004. There were 5,363 wells (4,274 producing wells, 1,075 plugged wells, and 14 other wells) in Sublette County in 2008, a 4-year increase of 1,935 wells. There were 2,964 wells in the Jonah-Pinedale Development Area (JPDA) in 2008, a 4-year increase of 2,063 wells, or about 515 new wells each year. The increase in JPDA wells has been offset by other Sublette county wells not in the JPDA being plugged and abandoned (2,063 - 1,935 = 128). Since about 1995, Wyoming has had a rigorous Title V inventory program, so the aspects of this inventory development program was focused on all aspects of the exploration and production of oil and gas. Inventories have been developed on a well-by-well basis.

Charge Questions

- **3) Which source categories did they improve and what methods did they use?**

- The total number of sources and number of speciated emissions at each well from all oil and gas related sources have greatly increased. The first inventory collected in 2004 covered 8 emission sources (drill rigs, wellhead engines, process burners, tanks, dehydration units, pneumatic pumps, well venting, and well completions) at well sites, and 7 different pollutants (NO_x, SO_2, Total VOCs, and BTEX). The number of sources has now increased to 14 (now including fugitives, truck loading, non-road mobile, on-road mobile on both paved and unpaved roads, flares and compressor engines), and the number of pollutants has increased to 25. The WDEQ is currently in the process of developing field specific emissions equations for each gas field in Wyoming. Currently, equations have been developed for the three gas fields in the only proposed ozone non-attainment area. The equations are for uncontrolled flashing emissions from condensate storage tanks, and are on a speciated hydrocarbon basis (one equation for methane, one for ethane, one for propane …). WDEQ/AQD is working on developing equations for uncontrolled emissions from glycol dehydration units.

Charge Questions

- **4) What kind of before/ after differences in emission estimates and modeling results are they seeing?**

- One thing the WDEQ/AQD has looked at is the reactivity of different speciated hydrocarbons with NO_x in the formation of ozone. By looking only at total VOCs, reactive pollutant concentrations may be under or over estimated. As an example, the WDEQ/AQD has determined that Toluene, Xylene and Formaldehyde are highly reactive, but alkanes, like Propane, are not very reactive. By knowing which hydrocarbons to focus on provides information on the respective sources, inventories and control strategies. BTEX is primarily emitted from storage tanks and dehydration units; the leading NO_x sources include drill rigs and compressor stations; and formaldehyde primarily comes from lean burn, gas fired compressor engines.

Charge Questions

- **5) Is there NEI analysis that would be particularly helpful to their efforts?**

- The fine scale modeling currently being used by the Wyoming DEQ/AQD is primarily focused on the oil and gas industry. Emissions from individual production sites are typically submitted to the NEI/EIS as area sources on a county-by-county basis. Since our modeling effort is on 1 km grid cells, and with only approximately 25% of the land in Sublette County containing production sites, the NEI does not provide enough detail needed for our uses. The NEI also only requires minor source inventories once every three years, and in an industry where over 500 new wells are drilled every year, NEI data can be out of date. Additionally, complete oil & gas inventories for use in modeling efforts are hard to come by.

Charge Questions

- **6) At what step in their process?**

- Wyoming is currently working with a contractor to develop an ozone model to use in the UGRB that will use the developed inventory and result in producing modeled ambient ozone levels as seen at the 3 monitors in the area. This is a unique situation in that all development occurs within a basin that is surrounded by high mountain ranges to the west, north and east, and elevated ozone is produced during winter time inversions with stagnant conditions and plentiful snow cover.


Questions?